US Army Corps of Engineers
Hydrologic Engineering Center

Proceedings of a Seminar on

Initial Project Management Plans for Hydrologic Engineering and Economic Analysis

22 - 24 September 1992
Otter Rock, Oregon

SP-25

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
22-24 September 1992	Seminar Proceedings	

4. TITLE AND SUBTITLE	
Initial Project Management Plans for Hydrologic Engineering and Economic Analysis	5a. CONTRACT NUMBER
	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)	
CEIWR-HEC	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5F. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
US Army Corps of Engineers Institute for Water Resources Hydrologic Engineering Center (HEC) 609 Second Street Davis, CA 95616-4687	SP-25

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/ MONITOR'S ACRONYM(S)
	11. SPONSOR/ MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Hydraulics and Hydrology Branch, HQUSACE and the Corps Hydrology Committee co-sponsored a workshop on Initial Project Management Plans (IPMP's) on 22-24 September 1992. The Portland District and North Pacific Division hosted the workshop at the Inn at Otter Crest, Otter Rock, Oregon. The Hydrologic Engineering Center (HEC) was responsible for the technical program and workshop coordination.

The purpose of the workshop was to provide a forum for sharing experiences in the development and application of Initial Project Management Plans. The workshop consisted of four half-day sessions and one evening session. Sessions included Headquarters Perspectives of IPMP's (Planning, H&H, Economics, and Project Management), case studies of projects that used IPMP's and future development and utilization of IPMP's. Most sessions consisted of several paper presentations and a panel discussion at the end. These proceedings are a compilation of all the papers and panel discussions presented at the workshop.

15. SUBJECT TERMS
Initial Project Management Plans (IPMP), feasibility phase, reconnaissance phase, hydrology, hydraulics

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
U	U	U	UU	239	19b. TELEPHONE NUMBER

Proceedings of a Seminar on

Initial Project Management Plans for Hydrologic Engineering and Economic Analysis

22 - 24 September 1992
Otter Rock, Oregon

US Army Corps of Engineers
Institute for Water Resources
Hydrologic Engineering Center
609 Second Street
Davis, CA 95616

(530) 756-1104
(530) 756-8250 FAX
www.hec.usace.army.mil

SP-25

INITIAL PROJECT MANAGEMENT PLANS FOR HYDROLOGIC ENGINEERING AND ECONOMIC ANALYSIS

22-24 September 1992
Otter Rock, Oregon

Day 1 Conference Overview and HQ Perspectives

Case Studies for IPMP's

Day 2 Case Studies of IPMP's - continued

FOREWORD

The Hydraulics and Hydrology Branch, HQUSACE and the Corps Hydrology Committee cosponsored a workshop on Initial Project Management Plans (IPMP's) on 22-24 September 1992. The Portland District and Division hosted the workshop at the Inn at Otter Crest, Otter Rock, Oregon. The Hydrologic Engineering Center (HEC) was responsible for the technical program and workshop coordination.

The purpose of the workshop was to provide a forum for sharing experiences in the development and application of Initial Project Management Plans. The workshop consisted of four half-day sessions and one evening session. Sessions included Headquarters Perspectives of IPMP's (Planning, H&H, Economics, and Project Management), case studies of projects that used IPMP's and future development and utilization of IPMP's. Most sessions consisted of several paper presentations and a panel discussion at the end. These proceedings are a compilation of all the papers and panel discussions presented at the workshop.

ACKNOWLEDGEMENTS

The Portland District and North Pacific Division offices hosted the conference and did an excellent job in selecting the conference site. Special thanks to Peter Brooks and Doug Speers of the division office for handling the logistics. Opening remarks for the conference were made by Ron Mason of the Portland District. His participation in the conference was appreciated.

Steve Cone and Lew Smith, HQUSACE, provided several excellent suggestions for topics and participants in the workshop. Darryl W. Davis, Director and Michael Burnham, Chief of the Planning Analysis Division, HEC, contributed significantly to the content and format of the workshop. Gary Brunner, Training Division, HEC, was responsible for putting the agenda together, contacting and arranging presenters, and publishing the workshop proceedings. Special thanks to Eileen Tomita, Training Assistant, HEC, for putting together the workshop invitation and information packets, the workshop binders, and the final proceedings. Eileen did her usual excellent job at making sure the workshop ran smoothly. Finally, thanks to all the workshop participants for taking the time to put together excellent papers and presentations.

INITIAL PROJECT MANAGEMENT PLANS FOR
HYDROLOGIC ENGINEERING AND ECONOMIC ANALYSIS

22-24 September 1992
Otter Rock, Oregon

Day 1 Conference Overview and HQ Perspectives

Time	Description
8:00- 8:10 a.m.	**Introduction** (Ron Mason, Portland District)
8:10- 8:20 a.m.	**Conference Overview and Objectives** (Gary Brunner, HEC)
8:20- 8:50 a.m.	**Overview of IPMP's - Planning Perspective** (Steve Cone, HQ)
8:50- 9:20 a.m.	**Overview of IPMP's - Econ Perspective** (Steve Cone, HQ)
9:20- 9:40 a.m.	Break
9:40-10:10 a.m.	**Overview of IPMP's - H&H Perspective** (Earl Eiker, HQ)
10:10-10:40 a.m.	**Overview of IPMP's - Project Management Perspective** (Pete Luisa, HQ)
10:40-10:50 a.m.	Break
10:50-11:50 a.m.	**PANEL Discussion - Washington Level Review Center** - Art Klingerman, WLRC - Jim Smyth, ASA - Lew Smith, HQ - Doug Kamien, HQ
11:50- 1:00 p.m.	Lunch
	Case Studies for IPMP's
1:00- 2:30 p.m.	**Chattanooga, TN - Large Urban Study** (Nashville District) - Linda Hendricks (Project Manager) - Harry Blazek (H&H)
2:30- 3:00 p.m.	Break
3:00- 4:30 p.m.	**Importance of the Study Team** (Huntington District) - Jerry Webb (H&H)

Day 2 Case Studies of IPMP's - continued

Time	Description
8:00- 9:00 a.m.	**Milwaukee, WI - Small Channelization Project** (Detroit District) - Bob Elkin (Project Manager) - Don Woodley (Economics)
9:00- 9:30 a.m.	Break
9:30-10:15 am.	**Johnson Creek** (Portland District) - Pat Obradovich (Economics) - Jim Sherman (Economics) - Al O'Connor (Plan Formulation)
10:15-11:00 am.	**Hydrologic Engineering IPMP: A District Perspective** (St. Louis District) - Gary Dyhouse (H&H)
11:00-12:00 noon.	**PANEL Discussion - Using IPMP's as a Living Document** - John Rushing (South Atlantic Division) - Ken Cooper (Omaha District) - Lauren Renning (Sacramento District) - Dan Harvey (Seattle District)

Single District Case Study - Petersburg, WV - Small Urban Levee (Baltimore District)

7:30- 8:15 p.m.	**Overview of Study by Study Manager** - Bill Haines (Project Manager) • Overview of Project • Development of IPMP • Application of IPMP • Reflections
8:15- 9:15 p.m.	**Viewpoint of Study Participants:** • Economic Viewpoint of IPMP - Cliff Kidd (Economics) • H&H Viewpoint of IPMP - Dennis Seibel (H&H)

Day 3	<u>Development and Utilization of IPMP's</u>
8:00- 8:45 am.	**Policy and Guidance for the Preparation of IPMP's**
	- Owen Reese (Norfolk, H&H)
8:45- 9:30 a.m.	**H&H Generic IPMP**
	- Mike Burnham (HEC)
9:30-10:00 a.m.	Break
10:00-10:45 a.m.	**Econ Generic IPMP**
	- Rayford Wilbanks, (Vicksburg, Economics)
10:45-11:30 a.m.	**Open Discussion** (Moderators - Earl Eiker & Steve Cone)
11:30-11:45 a.m.	**Summary and Closing** - Gary Brunner (HEC)

INITIAL PROJECT MANAGEMENT PLANS FOR HYDROLOGIC ENGINEERING AND ECONOMIC ANALYSIS

22-24 September 1992
Otter Rock, Oregon

LIST OF ATTENDEES

Participant	Office	Branch/Section	Telephone No.
Harry Blazek, Jr.	Nashville	Engineering-Planning Branch	(615) 736-2022
Peter F. Brooks	NPD	Hydrologic Engineering Branch	(503) 326-3488
Philip M. Brown	OCE (CECW-EP)	General Engineering Branch	(202) 272-8892
Gary W. Brunner	HEC	Training Division	(916) 756-1104
Michael W. Burnham	HEC	Planning Analysis Division	(916) 756-1104
Steve Cone	OCE (CECW-PD)	Economics & Social Analysis	(202) 272-0136
Kenneth S. Cooper	Omaha	Planning Division	(402) 221-4575
Gary R. Dyhouse	St. Louis	Hydrologic Engineering Section	(314) 331-8362
Earl Eiker	OCE (CECW-EH)	Hydraulics & Hydrology Branch	(202) 272-8500
Robert Elkin	Detroit	Plan Formulation Branch	(313) 226-6710
William Haines	Baltimore	Planning Division	(410) 962-4893
Daniel R. Harvey	Seattle	Hydrology Section	(206) 764-3590
Linda Hendricks	Nashville	Engineering-Planning Branch	(615) 736-2342
Clifford Kidd	Baltimore	Planing Division	(410) 962-3100
Arthur J. Klingerman	CEWRC-WLR	Management and Review Division	(703) 355-2472
Peter C. Luisa	OCE (CECW-LM)	Project Mgmt & Execution	(202) 272-0464
Ron Mason	Portland	Hydrologic, Coastal & River Engr	(503) 326-6442
Patricia Obradovich	Portland	Economics Section	(503) 326-5268
Albert O'Connor	Portland	Plan Formulation Section	(503) 326-6436
Lauren Renning	Sacramento	Programs & Project Management	(916) 557-7832
R. Owen Reece, Jr.	Norfolk	Hydraulics & Hydrology Branch	(804) 441-7772
James F. Robinson	SAD	Programs & Project Management	(404) 331-6841
Dennis Seibel	Baltimore	Hydrology-Hydrualics Section	(410) 962-4840
James Sherman	Portland	Economic Section	(503) 326-6438
Lewis Smith	OCE (CECW-EH-Y)	Hydrologic Engineering Section	(202) 272-8506
James J. Smyth	ASA-CW	Planning Policy and Legislation	(703) 697-7084
Jerry W. Webb	Huntington	Hydrology Section	(304) 529-5603
Paul Wemhoener	Portland	Planning Branch	(503) 326-6433
Rayford E. Wilbanks	Vicksburg	Economic & Social Analysis Branch	(601) 631-5463

HYDROLOGY AND HYDRAULICS WORKSHOP ON INITIAL PROJECT MANAGEMENT PLANS FOR HYDROLOGIC ENGINEERING AND ECONOMIC ANALYSIS

EXECUTIVE SUMMARY

WORKSHOP OVERVIEW

The Hydraulics and Hydrology Branch and Economic Branch, HQUSACE, and the Corps Hydrology Committee sponsored a workshop on Initial Project Management Plans for Hydrologic Engineering and Economic Analysis on 22-24 September 1992. The Portland District hosted the workshop at the Otter Crest Inn, Otter Rock, Oregon. The Hydrologic Engineering Center (HEC) was responsible for the technical program and workshop coordination.

The workshop consisted of four one-half day sessions and one evening session. There were 28 invited workshop participants who presented a total of 13 papers and 11 panel discussions. Participants included hydrologic engineers, economists, study managers, and other representatives from headquarters, divisions and district offices, and HEC.

The principal objective of the workshop was to provide a forum for sharing experiences in development of hydrologic engineering and economic Technical Studies Work Plans (TSWP's) for inclusion into the Initial Project Management Plan (IPMP) that is required as part of the reconnaissance-phase study. The importance of including detailed TSWP's as part of the IPMP was stressed throughout the workshop. A summary follows.

INITIAL PROJECT MANAGEMENT PLANS

The Initial Project Management Plan (IPMP), prepared and negotiated during the reconnaissance-phase study, documents the Federal and non-Federal efforts required to conduct the feasibility-phase study. It ensures that the work required for the feasibility phase has been carefully developed and considered. The IPMP is the basis for estimating the total study cost and non-Federal share. It also is the basis for assigning tasks between the Corps and the sponsor and for establishing the value of in-kind services.

The IPMP addresses the appropriate level of hydrologic engineering and economic analysis detail required for the feasibility-phase study. The IPMP must address all significant aspects of the technical analyses in the detail necessary so that the schedules, cost estimates, and in-kind services remain firm through the conduct of the feasibility-phase study. Uncertainties should be documented and considered contingencies which will be resolved during feasibility and/or preconstruction engineering and design.

The responsibility for preparation of the IPMP rests with the study manager, in coordination with the project manager. Technical disciplines, including hydrologic engineering and economics, are important to the IPMP development. Their participation to scoping the technical study requirements and providing TSWP's for integration into the IPMP are necessary for the conduct of a successful feasibility study.

TECHNICAL STUDIES WORK PLANS

Elements. Hydrologic engineering and economic TSWP's represent management tools that significantly enhance study efficiency and products. A work plan documents the study strategy including methods of analysis, work schedule, work item cost estimates, and staffing assignments. The document can be used informally in the hydrologic engineering or economic office, as well as formally at key study milestones such as for the IPMP to document study requirements. As a formal document, it is used for integrating the hydrologic or economic analysis with other disciplines, negotiating for resources allocation, and for obtaining consensus of the study approach with the study/project manager and others including the local sponsor. TSWP's are normally developed by the engineer or economist assigned as the lead for the study. For most studies, this should be a senior person. In some studies it may be developed by the supervisor or a junior person under the direction of the supervisor or senior staff person.

Strategy and Methods. The principal element of the TSWP is the definition of the study strategy and methods to be applied. It is the foundation from which the scheduling, cost estimates, and staffing requirements are developed. Previous or generic work plans may be used as guides or tailored to the particular study. The study strategy definition may be developed and presented in an annotated outline format, typically to three or four headings levels, although this will vary depending on the type and complexity of the study. The detail may evolve via periodic updates as the study processes.

The development of the hydrologic engineering strategy for the study should be based on gaining a good understanding of the key issues and concerns to be addressed in the analysis. The type of study and study objectives should be clearly understood and defined. Key aspects of the study to be addressed include: definition of the major issues (hydrologic engineering, flood damage, environmental, social, etc.) and likely methods to be used to perform the analysis; level of detail of the analysis; available information and requirements; interface with other disciplines; unusual features; study boundaries; and likely alternatives.

The formulation of the technical study strategy and procedures are based on discussions with peers, study/project managers, and other discipline staffs, review of available information including previous studies, and field reconnaissance of the study area.

Scheduling. The scheduling of key technical analysis tasks must consider the study milestones, needs of other disciplines for the information, and the availability of the staff to perform the study. Normally, Gant or Bar Chart type schedules are appropriate depicting one or two heading levels for the tasks and showing the major milestone dates. If problems are identified with scheduling, adjustment to the tasks defined for the study strategy may be required. The consequences of such actions should be noted and documented in a Memorandum for Record.

Study Costs. Cost estimates are derived from the study tasks. The estimates should be based on salary and overhead costs associated with the grade levels of the technical staff that will perform the analysis. The cost estimate is important and should be negotiated with the study/project managers for the study.

Staffing. The assignment of staff to conduct a hydrologic engineering or economic study is important to the conduct of the study. Often it is best to have junior analysts work under the general guidance of senior staff until experience is gained. Also, studies where experience and judgement are important to reaching a viable result, are often best performed by senior staff.

BENEFITS OF INTEGRATED IPMP's

Overview. Development of integrated IPMP's that include the hydrologic engineering, economic TSWP's require significant coordination and effort. However, the benefits associated with this IPMP are numerous as discussed in subsequent paragraphs.

Focussed and Integrated Analysis. A integrated IPMP requires the study participants to think through the study process, methods, and strategy prior to its initiation. Key issues are identified and methods for resolving those issues are clearly documented. This reduces false starts, minimizes problems with data integration and scheduling, and reduces the amount of inappropriate analysis scope and detail. It also enables documentation and referencing of regulations that are requirements for the study.

Reviews. A major advantage of an integrated IPMP is that the proposed strategy and resources requirements are documented and thus can be reviewed and critique by peers, supervisors, other disciplines, study/project managers, and outside agencies, and the local sponsor. This more open forum ultimately leads to better and more efficient analysis and far fewer acceptance problems throughout the progression of the study.

Negotiations. The development of the IPMP provides a means for the hydrologic engineering and economic study efforts to be negotiated and the consequences of reductions in scope/detail, funding, and staffing to be clearly defined. The paramount negotiation should be with the study/project manager for time and funding requirements. The technical disciplines must realize the needs of other participants and that the study resources are limited. The resulting IPMP may be used for in-kind services negotiations of portions of the hydrologic engineering and/or economic analyses by the local sponsor.

SUMMARY

Formal hydrologic engineering and economic TSWP's for conduct of the feasibility-phase study should prepared and integrated into the Initial Project Management Plan required at the end of the reconnaissance-phase study. The TSWP's may be included as appendices, and/or portions of them included in the main portion of the IPMP. The integration of the TSWP's into the IPMP is an important step presently neglected by many hydrologic engineering and economic staffs and study/project managers. The agreed upon IPMP must present the detailed study strategy, schedules, cost estimates and staffing for the conduct of the technical hydrologic engineering and economic analyses for the feasibility-phase study. It may be used for negotiations of in-kind services for the local sponsor. The study strategy must often be slightly modified and adjusted as the feasibility-phase study progresses. However, the schedule and cost estimate presented in the IPMP should remain firm and not be modified except for rare circumstances.

SUMMARY OF SESSION 1: INITIAL PROJECT MANAGEMENT PLANS (IPMP'S)

OVERVIEW

The first session included four papers and a panel discussion. The session focused on headquarters perspectives of the development and use of IPMP's. The four papers included a representative from Planning, Economics, Hydraulics and Hydrology, and Project Management. The panel discussion included four people form HQUSACE that are involved in the Washington level review process.

PAPER PRESENTATIONS

Paper 1. Steve Cone, Policy and Planning Division, HQUSACE, gave a paper entitled "Initial Project Management Plans - A Planning Perspective." This paper was developed by Mr. Harry Kitch, Policy and Planning Division, HQUSACE. Mr. Cone presented the paper because Mr. Kitch was unable to attend the conference. The paper emphasized that the purpose of the IPMP is to state the work requirements and the level of detail that is necessary to describe the without project conditions, formulate a range of alternatives, assess their effects, and present a clear rationale for the selection of water resource development plan(s). It was further stated that the IPMP forms the basis for estimating study costs, schedules, and assigning responsibilities. It is the road map for the conduct of the study. The paper went on to discuss the Planning Process, and how the IPMP can be used within the feasibility phase of a study.

Paper 2. Steve Cone, Policy and Planning Division, HQUSACE, gave a paper entitled "Overview of IPMP's, an HQUSACE Economic Perspective." Steve's paper began with a review of how the Corps currently performs reconnaissance phase studies. He then discussed the Feasibility Cost Shared Agreement (FCSA). Steve stated that once a potentially feasible plan is identified, the development of the FCSA and IPMP should begin. Steve stressed that time and money spent on developing a good IPMP would be "money well spent" when you get into the feasibility phase. Steve's paper discusses the development of IPMP's, specifically when they should be developed, how to develop it, and how to pay for it. Steve's paper goes on to outline how IPMP's can be used in the feasibility phase. He concluded his paper with some advice on how IPMP's can be improved.

Paper 3. Earl Eiker, Chief, H&H Branch, HQUSACE, presented a paper entitled "The Importance of the H&H Role in the LCPM Process when Preparing IPMP's." Earl began by emphasizing the importance of the IPMP. He stated that H&H is the most important engineering task in the feasibility phase. Because of the H&H importance, more time should be spent by the H&H community on the developing of their portion of the IPMP. The IPMP must anticipate all necessary studies and layout the study decision process for the development of the feasibility report. Earl went on to discuss how the IPMP can be used as a management tool during the feasibility study.

Paper 4. Peter C. Luisa, Project Management and Execution Branch, HQUSACE, presented a paper entitled "Initial Project Management Plans - A Project Management Perspective." Peter began his presentation by discussing why the Corps has initiated Life Cycle Project Management (LCPM). He stated that the LCPM process was instituted to improve performance by increasing accountability for costs, schedules, scope and quality, and by assuring project continuity. Peter believes that the IPMP is the single most important tool that a project manager has during the feasibility study. Yet the guidance on how to develop an IPMP is very sparse. Peter went on to say that one of the project manager's main jobs is to assess performance during the feasibility study. This can only be done with a well documented IPMP. Included in the IPMP must be measures to assess progress and performance, such as specific tasks, schedules, and costs. Peter concluded by saying that the IPMP is the project managers vehicle for establishing the expectations of all the study participants, including the customers.

PANEL 1: WASHINGTON LEVEL REVIEW PERSPECTIVES OF IPMP'S

a. James J. Smyth, Office of the Assistant Secretary of the Army (Civil Works), discussed his concerns over the fact that the Corps is not completing studies on time and within budget. He stated several reasons why this is happening: lack of attention to details; changes in policies and priorities during the study; not taking project management seriously; inexperienced people developing the IPMP; lack of cooperation, bad luck, and others. Mr. Smyth went on to discuss the concerns of our cost shared partners. In a recent GAO survey, non-federal sponsors expressed their concerns over changing scopes of work, increased study costs, and increased study duration. Mr. Smyth feels that more time spent on developing a good IPMP, outlining what really needs to be done in the feasibility study, will minimize the problems and concerns of our cost shared partners.

b. Arthur J. Klingerman, Chief, Management and Review Division, Washington Level Review Center (WLRC), began his discussion by describing the role of WLRC in the review of feasibility reports. The WLRC perspective is that of the technical policy/planning reviewer and the organization responsible to see that the questions and concerns of other participants are answered. Art went on to discuss recent significant report-review concerns. Art stated that one of the most common review concerns is the lack of support for the without-project conditions. Existing conditions engineering and economics are the basis for making decisions about the proposed project alternatives. Art's talk further discussed review concerns about the evaluation of alternatives, plan selection, incremental analysis of mitigation, justification of mitigation, and coordination/documentation. Art concluded by stressing that the IPMP is the road map for a successful feasibility study.

c. Philip M. Brown, Chief, Eastern Section, General Engineering Branch, Directorate of Civil Works, discussed the importance of the IPMP on the project development process from an engineering perspective. A typical Corps project should have a development time of approximately seven years. This period consist of a one year reconnaissance study, four year feasibility study, and two years for preconstruction engineering and design (PED). The feasibility study must be of sufficient depth to enable the project to survive PED without the need for reformulation. The IPMP is the tool utilized to accomplish these objectives.

d. Lewis A. Smith, Hydrology Section, HQUSACE, discussed some of the problems that occur during studies because of poor communication and a lack of team effort. Lew's paper discusses many problems that have occurred in the development of IPMP's caused by the traditional framework in which the Corps performs studies. His paper offers several suggestions to improve communication and team work.

INITIAL PROJECT MANAGEMENT PLANS - A PLANNING PERSPECTIVE

by

Harry E. Kitch, P.E.[1]

INTRODUCTION

The purpose of an Initial Project Management Plan (IPMP) for a feasibility study is to state the work requirements and the level of detail that will be necessary to describe the without conditions, formulate a range of alternatives, assess their effects, and present a clear rationale for the selection of water resource development plan(s). The IPMP forms the basis for estimating study costs and schedules and assigning responsibilities. An IPMP that has documented the alternatives to be evaluated and has clearly defined detailed work tasks will serve as a management control for the feasibility phase studies, establish the basis for changes, and help preclude communication and review problems. It is a road map for the conduct of the study. It is also a means for everyone who must be involved in the study, both in the conduct and the review and approval, to formally "buy-in" to the conduct of the study.

BACKGROUND

The Corps current two-phase, cost shared study process began in 1981 during discussions between the Corps leadership and the Assistant Secretary of the Army for Civil Works (ASA(CW)), Mr. William Gianelli.[2] Cost sharing was formalized for the first time when, in February 1982, Mr. Gianelli testified to his intent to administratively implement two-phase planning with a 100% Federally funded reconnaissance study to be done in 12 to 18 months followed with a 50/50 cost shared feasibility study. In January 1984 President Reagan wrote to Senator Lexalt that "... project planning generally will be shared with project sponsors."

This new approach to conducting feasibility studies continued to evolve when, in December 1985, the ASA(CW) Mr. Robert Dawson announced that study cost sharing (now included in both House & Senate versions of pre-WRDA 86 bills) would be administratively implemented (by EC 1105-2-162) in January 1986. In November 1986, the landmark Water Resources Development Act of 1986 was passed and study cost sharing became a formal part of the Corps way of doing business.

While the two phase planning process, which had evolved from the three stage process in 1981, had been used by the Corps for several years, study cost sharing brought new emphasis to the division of study effort between the reconnaissance and feasibility phases. The focus of the reconnaissance phase, then and now, is to do only that work which is necessary to: identify one plan that is engineeringly, economically, and environmentally feasible; demonstrate a Federal interest in implementation; and develop non-Federal sponsor

---

[1]Chief, Central Planning Management Branch, Policy and Planning Division, Headquarters, U.S. Army Corps of Engineers

[2]Plan for Planning 1986

support for cost sharing the feasibility phase. We must carefully consider the amount of detailed investigations and analyses and number of alternatives considered (in the reconnaissance phase) so that we and our non-Federal sponsors can move into feasibility expeditiously. To-date the reconnaissance phase process has been an effective mechanism for advancing only those studies into feasibility that have the greatest chance for implementation.[3]

Feasibility studies are undertaken in response to specific Congressional direction or other Congressional authority with the objective of formulating recommendable solutions to water resource problems. The feasibility report is intended to be a complete decision making document. It should include sufficient detail to support the conclusions and recommendations of the report and to enable reviewers to understand the rationale for these conclusions and recommendations. The report should demonstrate compliance with the Principles and Guidelines (P&G), the National Environmental Policy Act (NEPA), administration policy and other applicable laws and regulations.

While the Corps had used various management tools to guide the conduct of feasibility studies, such as plans of study), the advent of study cost sharing required a more formal approach. The Plan for Planning published in January 1986, presented, for the first time, the details of a Feasibility Cost Sharing Agreement (FCSA) and its main appendix, the Scope of Studies (SOS), which described the conduct of the feasibility study. This approach was formalized in February 1986 with the publication of EC 1105-2-162. The FCSA and SOS were further refined and developed through a series of major agreements among Corps elements and the ASA(CW) and were published in EC 1105-2-168 in September of 1987. This guidance remains essentially the same in the current planning guidance, ER 1105-2-100. With the Corps adoption of project management, the name of the SOS was changed to the Initial Project Management Plan. However the main goal of the FCSA and the SOS - a balance in the responsibilities and risks of the study process between the Corps and the sponsor - remained.

THE INITIAL PROJECT MANAGEMENT PLAN

Purpose of an IPMP. The purpose of an IPMP is to define and control the feasibility phase of water resources studies.

In guiding the conduct of the feasibility study, the IPMP spells out what alternatives will be considered, based on the results of the reconnaissance phase. Knowing what work is required (if not already done in the reconnaissance report) to completely establish the without project conditions, the study team can define the necessary work elements. Included in this work element definition process, is the establishment of the level of detail, how the element would be conducted and how the division of work, both by the Corps and the sponsor, will be accomplished. This definition then forms the basis for estimating the total study cost and setting the study schedule.

By using a team approach to develop the IPMP, it allows all parties to "buy into" study as they then understand how it will be conducted and what level of confidence they should

---

[3]Report on Reconnaissance Studies May 1990

expect in the results. The review of the IPMP, at both the division and headquarters levels helps to preclude review problems of the draft and final report. The higher levels have the opportunity to better understand what is being done and how it will be accomplished. This increased the level of confidence in the ultimate product and reduces the amount of review questions. This approach also allows for agreements on new or different approaches.

The IPMP also provides the basis for the changes that invariably happen during the course of a study. The impact, in both time and funds, is easily assessed and decisions can be made on how to proceed. Here the trade offs between effort in the feasibility and effort in preconstruction engineering and design can be made in terms of more certain decisions, earlier in the development process.

Parts of an IPMP. There are several parts of an IPMP that are called for in both the planning and project management regulations. The most important are:

- task specific, detailed scope of studies;
- work breakdown structure & responsibility assignment matrices;
- milestones; a schedule of performance and a mechanism for measuring progress;
- the baseline feasibility study cost estimate;
- procedures and criteria for reviewing and accepting work and ensuring conformance to policy;
- coordination mechanisms among the parties (internal & external); and
- references to statutes, regulations, & other guidance needed to conduct work.

Of all of these requirements, the most important is the identification and definition of the tasks. Here the details of the actual study effort are laid forth. These tasks are combined into products and ultimately into a feasibility report which serves as the decision document for Federal and local involvement in a project. The FCSA ties closely to these tasks (or more likely their products such as existing conditions hydraulics or economics (damages)) in requiring the Executive Committee to consider renegotiating the agreement if there are significant changes. The best way to avoid many changes is to carefully develop the IPMP in the first place. The series of questions in the next section provide some guidelines for that process.

DEVELOPING AN IPMP

To develop an appropriate IPMP, one must ask the right questions. Furthermore, one must know what questions to ask when reviewing the IPMP. Many times the lack of a detailed IPMP and the corresponding need for additional studies and funds during the feasibility phase occurs because the correct questions were not asked during development and review of the IPMP. If the correct questions are asked and answered, an IPMP will be developed that is comprehensive in scope, has sufficient information to describe study tasks, and defines the level of detail necessary for the studies. In developing and reviewing an IPMP the main questions to ask are: WHAT?, WHY?, WHO?, WHEN?, and HOW? Given the scope of study and alternatives to evaluate, the following questions should be used as a guide in developing the tasks necessary for feasibility studies.

1. What tasks are required? (What do you need to know to make a decision?)

2. Why is each task necessary? (How critical is it to the decision making? If it doesn't help make a decision, don't do it.)

3. How will each task be accomplished? (What techniques, models, procedures, etc. will be used?)

   a. What information is required to accomplish each task? Is the information available or do you have to collect or derive it?

   b. Who will accomplish each task? (In-house, contractor, etc.)

   c. When should each task be accomplished?

4. How much time and money should be devoted to each task?

CONCLUSION

An IPMP was originally conceived as a document to serve as a guide for the conduct of the study. The effort and thought expended in the beginning of the feasibility process will pay dividends during the entire study. However one must remember that an IPMP is a TOOL, not an end in itself!

ACKNOWLEDGEMENTS

I gratefully acknowledge the help from Steve Cone, Rayford Wilbanks, and others whose work formed the basis for this paper.

OVERVIEW OF IPMPs
AN HQUSACE ECONOMIC PERSPECTIVE

by

Steven R. Cone [1]

INTRODUCTION

The Economics and Social Analysis Branch of the Policy and Planning Division has, for some time, had a keen interest in the development of quality IPMPs, and most importantly, the associated task specific Scope of Studies, particularly since inception of the current two phase, cost-shared planning process. Many persons in Corps districts and divisions are probably tired of the constant barrage of comments, criticisms, and objections received from HQ Economics on the IPMPs submitted with their Reconnaissance Reports. We often here, "Why are you picking on Economics," and "Why do we have to include so much detail, we need to be flexible," and "Give us examples of what you want". Well... We're not picking on economics, it's just easier for us to point out the deficiencies in this area, and it won't stop... but, please take it personally. Without personal interaction, reaction, and responsibility we, as an organization, will never improve. With the exception of but a few, we feel like voices in the wilderness, crying the importance of carefully crafted, well prepared, detailed IPMPs. Without such quality documents we will continue to experience review problems, sponsor problems, and scheduling and cost problems.

When approached by Lew Smith to include economists participation in a joint workshop with his H&H committee, we were excited. When Lew asked our suggestions for topics, we initially provided a long list ranging from freeboard to risk and uncertainty analysis. But after further thought and consideration, we told Lew that the only topic worth discussing at this first, and hopefully the beginning of many, joint workshops, was IPMPs, the foundation for conducting studies.

Fortunately, during the past year, with the help of Lew Smith and Earl Eiker, we successfully enticed two Planning and Project Management Program associates into taking HQ assignments and class research papers relating to reviewing some of the problems in the system and developing some potential solutions and guidelines and with helping organize this conference. Rayford Wilbanks of the Vicksburg District Economics Branch and Owen Reece of Norfolk District H&H organization, who will be presenting papers latter in the program, eagerly tackled the challenge. With the organizational skills of Gary Brunner and his associates at HEC, this first joint workshop of Hydrologic Engineering and Economic Analysis has come to fruition. And with the participation of all attendees and publication of the proceedings, I am confident it will be a success.

---

[1] Economist, Economics and Social Analysis Branch, Policy and Planning Division, Headquarters, Corps of Engineers

PURPOSE

The purpose of this paper is to provide both a general overview and an insight into the current HQUSACE perspective, from an economic standpoint, of the purposes, uses, and development of Initial Project Management Plans for Water Resources studies and particularly flood damage reduction studies. This paper discusses the interrelationship of the Reconnaissance phase, the FCSA, and the IPMP. It offers goals, objectives, and expectations on the manners in which we develop and use IPMPs, as well as recommendations, or rather suggestions, on why and how improvements should and can be accomplished.

THE REQUIREMENTS AND RELATIONSHIPS

The Reconnaissance Study, the Feasibility Cost Sharing Agreement (FCSA), and the IPMP are closely interrelated. Each has specific objectives but they are dependent upon one another. The FCSA and IPMP are developed in the reconnaissance phase, are essential to completing it successfully, and take control of activities once it is completed. The Economist and the Hydrologic and Hydraulic Engineers are major team members in the successful preparation of each.

<u>The Reconnaissance Phase</u>. The reconnaissance phase of a water resources study is undertaken at the request of non-Federal interests and with Congressional authority. Its duration is 12 to 18 months and is 100% Federally funded. As proposed by Mr. Gianelli, former ASA(CW), in testimony before Congress in 1982, the reconnaissance phase would establish, as a minimum:

- "definition of problems and opportunities, as well as potential solutions
- determination of whether planning should proceed further; i.e. is there a 'Federal interest'
- an assessment of the level of interest and local support in cost sharing the feasibility phase
- an estimate of the cost of the feasibility phase and a detailing of necessary task."

The four principal objectives, reiterated and paraphrased in various forms are still the minimum requirements. One such paraphrasing (Fowler, 1986) characterized them as "The Four Horsemen" and listed them as:

a) What ails this place and what can be done about it? (problems and opportunities, and potential solutions)

b) Is there some economically justified project that the Feds would support?

c) What exactly is going to be accomplished in the feasibility study, if there is to be one? How long will it take and how much will it cost (scope of study)?

d) Are the locals interested in buying into a feasibility study, that is buying into c)?"

The importance of each of the "Horsemen" is dependent on when and where one is in the project development process. Clearly, the identification of at least one economically feasible plan which has a Federal (read, Army/Corps) interest is of paramount importance if there is any chance of a feasibility study being undertaken. Further, two of the tasks; obtaining Sponsor interest and scoping the feasibility study, would not even be undertaken without the identification of a feasible plan. But it is dependent itself on the identification of problems, i.e. defining the without project condition. And once the reconnaissance phase is completed and the FCSA is signed, it is the IPMP, the scope of the feasibility study, that essentially takes over and controls the course of events.

1) The hydrologic and hydraulic engineers and the economist are the principal players in defining the without project condition for most flood damage reduction studies (those which do not involve existing levees, flood walls, or unique soil characteristics where the Geotechnical and Structural engineers have equally import rolls). For it is these disciplines which must identify the risks and potential consequences of flooding. The hydrologist determines the likelihood and magnitude of a flood event, the hydraulic engineer determines where and how the waters will flow (the physical consequences), and the economist determines what the monetary consequences (NED losses) are likely to be. Without these players performing their responsibilities, no other study team members have major roles. That is, unless the nature, source, and location of the problem(s) are identified, formulation of alternative solutions and the impacts of those solutions cannot be undertaken.

2) Once a potentially feasible plan is identified, the development of an IPMP begins in earnest. Without it, Sponsor support and HQ certification cannot be obtained. Again the economist and the H&H team members play instrumental roles. While ideally the without project condition is fully described in the reconnaissance report, we know that with a 12 month schedule, limited funding, and with the other activities and tasks which must be accomplished, considerable uncertainty remains and more data must be gathered and loose ends must be tied-up. This is one of the principal reasons for developing a clear, concise and well defined scope of studies (IPMP). Again, once the reconnaissance report is completed, only the FCSA and the IPMP remain for the duration of the project development process.

<u>The Feasibility Cost Sharing Agreement</u>. The FCSA is the legally binding contract between the Corps and the non-Federal Sponsor which directs the course of the feasibility study. The IPMP is it's principal appendix and where the real division of responsibilities and definition of work to be accomplished is described.

1) While the FCSA itself has a very structured and modeled form there are both negotiable and non-negotiable items.

   a) Negotiable Items. Many items in the FCSA are negotiable within statutory, regulatory, and policy limitations. They include:

      - The Scope of Studies to be Undertaken
      - The Study Schedule
      - The Study Cost
      - Amount of Cash and In-Kind Contributions
      - The Value of In-Kind Contributions
      - The Allowable Time and Cost Changes Requiring Amendment to the Agreement
      - Make-up of Committee and Team Members
      - Coordination Mechanism
      - Review of Work

   b) Non-Negotiable Items. Other, and actually a smaller number of items are not negotiable, usually because of statutory requirements. They include:

      - Cost Sharing (50% non-Federal with no more than 25% in-kind)
      - Use of Other Federal Funds for Non-Federal Share (without certified approval of agency)
      - Lobbying Documents
      - Compliance with Laws and Principals and Guidelines
      - "Boilerplate" Provisions
        - Settlement and Appeal of Disputes
        - Maintenance of Records
        - Relationship of Parties
        - Officials not to Benefit
        - Federal and State Law
        - Covenant Against Contingent Fee

2) As can be seen in the listing above, the majority of the negotiable items are directly associated with the IPMP. The scope of work, the amount and value of in-kind contributions, the study cost and schedule, even the allowable amount of time delay and cost increase for a specific work task (not to exceed 30 days and/or 15%) which requires modification or amendment to the FCSA, and the review of each others work, are all integrally related to the IPMP. Though it is only an appendix, it is one appendix the body cannot survive without. Furthermore, the FCSA is basically a model (Appendix E of ER 1105-2-100) to follow, i.e. it is virtually done for you. The most difficult and most important part, the part that must be developed between the Sponsor and the Corps, the IPMP, has no model but merely a listing of items which should be included.

The Initial Project Management Plan. As mentioned above, the FCSA is basically a form to fill in the blanks. It is the IPMP, like the Project Management Plan (PMP), which forms the basis for controlling the conduct of the feasibility study, for communicating with the Sponsor of study needs, for upward reporting of progress, and often, times most importantly, establishing the basis for change. It is the Plan for Planning.

The Guidance. Again, the IPMP has no model, but rather a listing and discussion of it's principal components in our guidance. It is worth identifying and briefly reviewing the guidance which can be found in the following documents.

- Planning Guidance - ER 1105-2-100, Chapter 2
- Project Management - ER 5-7-1(FR)
- CECW-P Oct 88 Memorandum, Subject: Reconnaissance Studies Phase Seminar

The principal components listed and discussed in the guidance include:

- Task Specific, Detailed Scope of Studies
- Milestone Schedule
- Work Breakdown Structure & Responsibility Assignment Matrix (WBS & RAM)
- Baseline Feasibility Study Cost
- CPM or Other Visual Network of Study
- Procedures for Reviewing and Accepting Work
- Coordination Mechanism Between Parties
- References to Statutes, Regulation, and Other Guidance

This is quite a list, and is probably not complete. Frankly, I could not accurately define each of them with a great deal of confidence and authority. However, the most significant of these, and the real basis for the balance, is the first, the identification and definition of work tasks to be accomplished. This includes not just what tasks are to be done, but how each task is to be accomplished, by whom, when and how long each takes and how much each costs. Without it, the balance of the components are not worth attempting.

DEVELOPMENT AND USES OF THE IPMP

When, How, and Cost to Develop. The question of when an IPMP should be developed is an easy one answer, the how requires a little more planning and thought. The cost of preparing a quality IPMP is another matter.

1) When? The IPMP should be developed near the end of the reconnaissance when it is clear that it is highly likely that the study will result in a recommendation to proceed into the feasibility stage. Remember, the requirements of this probable recommendation include the identification of a problem that fits into one of the "high priority" areas (i.e. flood or storm damage reduction, navigation improvement, and environmental restoration), at least one plan is identified that is economically feasible, environmentally acceptable, engineeringly do-able, and the local Sponsor is likely to support further cost-shared studies. A draft of the IPMP should be submitted to HQ

prior to the Reconnaissance Review Conference along with the report. HQ must certify the FCSA (with IPMP), as well as, the Reconnaissance Report before final negotiations with the Sponsor and feasibility funds are allotted.

2) How? To begin with, each study team member, after appropriate team meetings and one on one discussions, should prepare the narrative descriptions and time and cost estimates of each task and sub task of their respective work items for inclusion in the overall scope of studies. This should include specifying what information needs to be furnished by other team members. It is imperative that the economics and the H&H team members work closely to ensure cooperative efforts to better define the without condition and evaluation of alternatives. Once the scope, schedule, and cost of each task is defined, the study manager (or project manager) can begin the integration of the overall scope and completing the other components of the IPMP. This is likely to involve an iterative process to keep the costs in line with Sponsor and Corps expectations and acceptability. The first IPMP will most likely take considerable time, but once models are established, they should become easier.

3) Cost? We often hear "It costs too much to prepare the kind of detail you HQ folks are asking for and we have limited reconnaissance funds." Well... it's going to cost someone, sometime to define what needs to be done and how it is to be accomplished. It is better, from the Sponsor's standpoint, to do it during the reconnaissance phase that wait until feasibility studies which have to be cost-shared.

   How often and how much effort is expended during the feasibility phase holding meetings to define and discuss work tasks and resource needs?

   "Who shall you rob to pay Paul? Anyone you can, including Peter if necessary." (Fowler 1988) And might I add, get some of Mary's money too!

   It is true, the first IPMP will be both time consuming and somewhat costly, but they should get easier and cheaper as models are developed and we get more experience.

<u>Defining the Tasks</u>. How much detail and how specific should the tasks be? This is not at all an easy question and the following answer may not be entirely satisfying for those who want to be told exactly what to do and have difficulty thinking on their own. It is like asking how much detail should be in a Reconnaissance or Feasibility report, or even a Design Memorandum.

Basically, the scope should be in enough detail regarding tasks and costs that the team members, including the Sponsor, and reviewers can obtain a thorough understanding of what each task is, how it to be accomplished, how the time and costs are determined, and the expected quality of the results. They also need to understand why the tasks need to be done, how the tasks interrelate and how the overall study process ties together. Remember, Sponsors may contribute in-kind services toward the study process, so the tasks should be clear enough that they can identify their capability and desire to accomplish some of them.

The CECW-P Oct 88 Memorandum on the Reconnaissance Phase Studies Seminar mentioned earlier, stated that "....The SOS will be detailed to the specific task level. This should be similar in scope and form to the detail that would comprise a scope of work for a procurement action for the investigation." This is ambitious, but should very well be our goal. The following offers some suggestions as well as cautionary observations regarding defining of study tasks.

1) Cost and Time Limits. The FCSA includes a clause that states that the agreement must be modified if any task exceeds the scheduled completion date by more than __ days (not to exceed 30 days) and/or a cost of more than ___% (not to exceed 15%). These are negotiable amounts, up to the limits. Caution should be used in defining tasks so specifically as to require constant modifications to the FCSA, particularly for items not on the critical path.

2) Use of Sub-Tasks. One way to clearly communicate and document the work requirements for Sponsors, Corps team members, and reviewers, is to define sub-tasks in the scope of studies. This may allow the study to proceed without unnecessary modifications to the FCSA.

Uses of IPMP. Without elaborating on the standard uses of the IPMP such as obtaining certification, measurement of study progress, keeping track of costs and schedules, upward reporting, etc., I would like to point out some of the not usually thought of and potential uses.

1) Work Orders. Well defined tasks and sub-tasks can be the basis of work orders issued by the study manager (or project manger) to other team members. This can save substantial time and costs during the conduct of the feasibility study.

2) Basis of Change. There are often requests to increase study costs and time to accomplish additional work or evaluate new alternatives. Without a well defined IPMP which outlines the alternatives to be studied and specific tasks, it is often difficult to convince Sponsors and HQ to provide the additional funds and extend the schedule. The IPMP can be the best and most defensible instrument for providing justification for changes. Remember, it is a road map and should be viewed as a "Living Document." (This is not to imply that it should be done poorly because it will change anyway.)

3) Review Instrument. Though currently not used in this manner, the IPMP could be a valuable tool in the review process. Since all participants, including the district, the sponsor, and the reviewers (except WLRC and BERH), are in essence "buying into" the study through the FCSA and the IPMP, it could be part of the submission of the Feasibility Review Conference materials along with the draft report. This may be somewhat risky to the district which did not follow the IPMP but it can also be very beneficial in avoiding and overcoming potential review problems. An IPMP which clearly delineates the alternatives to be evaluated and thoroughly describes the

technical studies to be accomplished, can diminish the reviewer's desire to recommend more alternatives or require additional studies. This is by no means a panacea, but a reviewer is less likely to require work that is not included in an agreed upon IPMP.

ADVICE AND SUGGESTIONS ON IPMP's

Because we in HQ Economics review all reconnaissance reports and participate in virtually all RRCs, we see a variety of IPMP's. The Good, the Bad, and the Ugly. And quite frankly, most fit into the second and third categories. We often see tasks defined in simple lists of major functional areas such as:

Plan Formulation	$ 50,000
Economics	$ 60,000
Hydrology	$ 40,000
etc.	

Sometimes they get so clear as to include such verbiage as "Do" or "Update" in front of the line items. Or even include such clear descriptors as "complete surveys and evaluate plans, including NED plan," or "take additional cross sections and run HEC 1 and 2."

We have also seen thirty page scopes of work (not to be confused with the overall IPMP) where each functional component is broken down into such excruciating detail that virtually every step in the data collection and analysis is laid out including how the pages of field data are to be numbered. (We really haven't seen too many of these and perhaps this is a bit of exaggeration). We believe the appropriate scope of the definition of tasks lies somewhere in between. Be specific but concise and focus on the key areas.

1) Without Condition. The most common problem in studies is poor definition of the without condition. When reports show that substantial damages occur at the 2-yr frequency flood event and there has been no record of flooding in the past twenty years, something is wrong. This should be taken care of in the reconnaissance report, but often it is not. Ensure sufficient resources are committed and technical studies are included in the IPMP to present a convincing case for the without condition. The existing condition is a good start, and for most flood control studies is the key. Don't spend a lot of resources forecasting, no one does it well, and the best projects stand on existing conditions.

2) Sampling. Sampling is, in general, an efficient way to collect data. The hydraulic engineer uses it all the time by taking representative cross sections. Structured, representative sampling of property values and types is a useful and cost effective way of collecting economic data. The IPMP should include information on how the sampling is to be structured and what data is to be collected.

3) Mainline Benefits. Focus most attention on the "mainline" benefits, i.e. flood damage reduction to existing development, flood insurance savings, emergency repair and recovery cost savings, etc. The best flood control projects rely largely on these

existing benefits. A well documented BCR of 0.9 with reasonable arguments for enough future benefits for feasibility is better than a weakly documented project with a BCR of substantially greater than 1.0 which relies heavily on futures. Projections of future growth based on secondary data and indices, increased and restoration of market values, location benefits, etc. are difficult to substantiate and create credibility and review problems.

4) Risk and Uncertainty. Prepare for it. Recently published draft guidelines requiring incorporation of risk and uncertainty analysis directly and explicitly in feasibility reports for flood control studies should be read, understood, and the plan for compliance should be included in the work tasks of the IPMP. These are not new concepts. In fact, the requirement has long been in the Principals and Guidelines. Only recently have explicit instructions and examples been provided. The costs initially may be more, but the quality of results of the studies and the information provided decision makers and the public will be superior.

SUGGESTED SYSTEMATIC IMPROVEMENTS

If we, as an agency, are to continue to successfully meet the challenges of cost sharing and continue to be a leader in water resources development, we must continue to improve in how we define the scope and conduct our feasibility studies. Improvements in guidance, communication, and performance are essential.

1) Guidance. Improvements to guidance include:

   a) Reach consensus on Planning and Project Management roles and responsibilities and develop consistent guidance in the regulations.

   b) Better define the components and expectations of IPMPs.

   c) Consider using the Work Breakdown Structure products in the IPMP as the basis for modifications to the FCSA.

   d) Require that a draft IPMP be submitted with the draft reconnaissance report before holding any RRC.

   e) Require that the current IPMP be submitted as part of the draft feasibility report for use in review.

2) Communications. Improvements in communications include:

   a) Develop models and examples of quality IPMPs and disseminate to districts and divisions.

   b) Recognize, distribute, and share good examples of IPMPs.

   c) Hold regional workshops and incorporate IPMP training into PROSPECT courses.

d) Make widespread distribution of the proceedings of this workshop.

CONCLUSIONS

Our intentions and the goals of this workshop are to further the communication and team work of the H&H and Economic community within the Corps of Engineers and to enhance the "State-of-the-Art" of the development of IPMPs. Earl Eiker, Lew Smith, Harry Kitch, and Bob Daniel were instrumental in seeing that this workshop was held. We have committed ourselves to the overall improvement of how the Corps views and prepares IPMPs. We firmly believe, that if the Economic and H&H community within the Corps can develop good models and examples of task specific scopes of work for our respective areas of expertise, others will follow. The participants of this workshop were specifically invited because we believe they can contribute to this effort.

I want to recognize the efforts of Rayford Wilbanks, Owen Reece, Gary Brunner, and all of the participants of this workshop in helping making the message heard.

REFERENCES

Fowler, Brad. "Level of Detail in Reconnaissance Reports," Proceedings of a Seminar on Flood Damage Reconnaissance-Phase Studies, August 1988.

The following is a summary of what Mr. Earl Eiker discussed.

THE IMPORTANCE OF THE H&H ROLE IN THE LCPM PROCESS WHEN PREPARING IPMP'S

by

Earl E. Eiker[1]

The introduction to the Corps of LCPM concept has been a painful process over the last few years. The process has pitted many parochial interests against one another with occasional battles. But the Corps leadership and my boss, Paul Barber, are committed! The LCPM process can work and is yielding beneficial results today. One of these is the IPMP. The IPMP is the single most important document in the early life of a project and can be of critical importance later for approval of the feasibility report. An IPMP must anticipate all necessary studies and layout the study decision process for the development of the feasibility report. Anticipating all of the necessary studies has to include the H&H studies covering basic analysis of methods and concepts required to evaluate project impacts and performance for benefits, environmental concerns, safety and residual problems. A new study issue coming on the scene is risk and uncertainty. Studies incorporating these concepts and methods are vital to the approvals and to the OMB budget process.

<u>The Importance of the H&H Role in the LCPM Process when Preparing IPMP's</u>.

a. The IPMP is the most important document in the LCPM process, but must address clear goals and be a team effort.

b. The cost of doing a "good" IPMP should be measured against problems that could arise during feasibility without a good IPMP, size of the project, etc.

c. Technical input is critical.

d. Coordination and communication are a must - up, down, and across.

e. If there are setbacks in time or funds, such that the "complete" study can't be done - we must be able to quantify the loss!

f. Make room in the IPMP to accommodate change. Contingencies, float, etc.

g. Use the IPMP as a "roadmap," forward looking "living" document.

---

[1]Chief, Hydraulics and Hydrology Branch, HQUSACE.

INITIAL PROJECT MANAGEMENT PLANS
A PROJECT MANAGEMENT PERSPECTIVE

by

Peter C. Luisa [1]

INTRODUCTION

In FY 88, a limited comparison of performance related to estimated project completion costs and schedules, reflected that over 70% of our ongoing construction projects were showing cost growth and schedule slips above those estimated from the previous year's Congressional budget testimony. This was based on an analysis of projects in the Construction General account. Projects in classified in Preconstruction, Engineering and Design stage were not showing much better results. This was a basic focus by Mr. Page the then ASA(CW) and these results, coupled with his experiences in private practice, caused him to have the Corps institute changes in the way they are structured in order to provide a more direct link to performance and accountability on cost and schedules.

Project Management as an entity with specified roles and activities, was formally initiated with ER 5-7-1 dated July 1989. This was later superseded by the update of that regulation with the 8 Mar 1991 (FR) version. In both those regulations and in all of the current discussions taking place throughout the Corps in further refining Project Management, the purpose and the goal of the Corps of Engineers in instituting Project Management is to improve performance by increasing accountability for costs, schedules, scope and quality and by assuring project continuity. In all of the wrangling and discussions on how to formally implement this cultural change within the organization, this has always remained the focus of project management.

Under this system, the Project Manager is vested with the responsibility for managing projects to the parameters of cost, schedule, budget and quality, and with the authority to manage and oversee the relationships of those involved in the project process such as customers and technical elements.

THE PROJECT MANAGER AND THE IPMP

Much has been discussed regarding the role of project manager vs. technical manager, at what point each manager comes into play, who is in charge of what, what is or is not "under" project management etc. Many workshops, retreats, team building sessions, and workshops, throughout the Corps have been conducted to aid in better defining roles and responsibilities. A new generation of guidance is currently being prepared, through the revision of ER 5-7-1, providing guidance in carrying out the project execution mission. Much

---

[1] Central Area Team Leader, Project Management & Execution Branch, U. S. Army Corps of Engineers, Headquarters

of this serves to better delineate the project team roles and responsibilities. Consequently, it serves to better define the Project Manager and the project Management system. But, we must not lose sight of the fact that all of this is being done with the improvement of project execution in mind. Underlying this management role, the PM has the responsibility of integrating the players throughout the project development.

As is currently defined, the feasibility study is but one product in the overall progression of a project towards successful completion. The Project Manager is responsible for management of the overall project. As such, the PM has the role of integrating the study with the project management parameters. This starts during the reconnaissance and extends through feasibility, design construction and into project operation.

Initial Project Management Plans (IPMP's) are the single most important tool for management of the overall feasibility study. Yet they have been sparsely addressed in both the prior as well as the existing rounds of project management regulations. Other than stating that an IPMP is necessary, is developed by the Planning Technical Manager in coordination with the PM and other technical managers, and that it is a necessary element to successful project execution, there is little to be gleaned in the way of "meat" in the current set of regulations, other than some highlighted items detailed in paragraph 5(a) of ER 5-7-1. While the guidance on developing Project Management Plans is relatively extensive, in that the required 21 elements are specifically detailed and discussed in the regulation, the specifics of IPMP's are lacking. There are basic rudiments of a good IPMP in the regulation when referring to the purpose of the IPMP, only. How to put it into words, negotiate the specifics of the activities to be performed, estimate their time, estimate their cost, and thereby make the IPMP into an effective tool, is left up to the fields' own devices. Piece of cake!

The current version of guidance on Project Management, commencing with EC 5-1-48 of 24 April 1992, details the project managers role, as well as other team members, by expanding on the definition of the "project" and defining the individual roles and responsibilities in carrying out the execution of the project. This latest round of Project Management guidance emphasizes the fact that the Project Manager is to be assigned when a Reconnaissance is nearing completion and will participate in the preparation of the IPMP. Once the IPMP is prepared, the PM manages the execution and assesses the performance of the progress of the project (in this case, during the feasibility stage) and controls and allocates funds on a periodic basis. This guidance will also include details on Work Breakdown Structure together with highlighting other available tools. Therefore, the PM must be totally involved in the development of the IPMP. The PM is responsible for presenting it to the Project Review Board and the sponsor for and approval.

IPMP AND PERFORMANCE

As stated above, one of the project managers responsibilities is to assess performance. Currently, limited assessment of performance is conducted through the Command Management Review process. Currently, the only indicator that even approaches performance evaluation is the analysis of the GI expenditure account, (Fig. 1). But greater attention is being paid to performance at all levels, and additional indicators are now being developed to track project cost and schedules at every phase of a projects development.

These indicators will be looked at across MSC lines, by project purpose and by account code. This will be part of the PRB process. We will be making greater use of the Lifecycle Reporting System and Earned Value Charts for these analyses, therefore data reliability is of utmost importance.

Several of these indicators will focus on the feasibility phase of a project. We have been seeing a steady improvement in adherence to cost and schedules in the CG arena. The percentage of construction projects undergoing cost increases has gone from greater than 70% prior to 1989 to 60% in 1990, 40% in 1991 and 30% in 1992 testimony comparisons. Similarly for Project Schedules, the percentage of projects suffering schedule slips has gone from, again more than 70% of all projects undergoing slips in completion schedule prior to 1989, to 61% in 1990, 27% in 1991 and 19% in 1992.

Performance indicators on cost and schedule for projects in the feasibility stage, analogous to those in the CG stage, are not readily available. But a trend for study completions does indicate that the time to complete studies is creeping upwards, and is now approaching 5 years, (Fig. 2). There are many reasons for this, one of which is that we may be asking more and more from the feasibility stage. This is not necessarily poor performance. What would be poor performance, is if we have a commitment to an established estimate of schedule and cost in an IPMP, and we do not deliver. Our customers are paying greater and greater attention to costs since they have a vested, financial interest in maintaining costs and schedules to THEIR budgets, as well as ours.

Measures to assess progress and performance must be included in the IPMP itself, thereby putting everyone on notice how the project is progressing and is being viewed by high authorities. Once the IPMP is established,it is to be used by the PM to ensure the schedules and costs are adhered to in accordance with the agreed upon IPMP. Therefore it behooves everyone involved to be sure that great attention is paid to the requirements that are developed within the document.

One other area of importance in relating the IPMP to performance is in what is probably the greatest growth industry in government today, and that is in AUDITS. We are experiencing more external review of our activities than ever before. There is a plethora of agencies reviewing our activities and the Feasibility performance arena is just one. AAA, IG, GAO, are all investigating our programs for adherence to performance, to the cost of doing business, to the execution of agreements, to the use of funds and to the accountability for carrying out what is stated in the executed documents. Only with detailed, coordinated, IPMP development, and strong management of the of the commitments made in the IPMP, can our performance in project execution improve.

CONCLUSIONS

The goal of the Project Management process is the efficient execution of a quality project. Projects are now to be conducted within the confines of the Project Management system as defined and practiced by the Corps of Engineers. Within that framework, each member of a project team has a role.

The ultimate purpose of the IPMP in the production of that project, is the same as with any plan of action; to detail the elements and the activities that will be conducted during the course of that activity. The greater attention to detail placed by all members participating in the activity, the greater reliability on what is in the IPMP. The greater reliability on what is in the IPMP, the better the performance of the project execution when comparing what actually takes place against what has been promised.

The IPMP is the PM's vehicle for establishing the expectations of all participants of the feasibility process, including the customers. The IPMP must also be maintained as an active document, reflecting the changes that have occurred to the expectations and commitments of the project team, as well as the scope, quality, schedule and cost and budgets for production.

Project Managers have a unique and vital role to play in the development of the IPMP in that part of their responsibility is to monitor performance, control funds, and be responsible to the customers for the products' timely, cost effective completion.

CREDITABILITY AND ACCOUNTABILITY IN DEVELOPMENT OF INITIAL PROJECT MANAGEMENT PLAN

by

James J. Smyth[1]

It is important that the Army Corps of Engineers deliver projects on time and within budget. A well thought out Initial Project Management Plan (IPMP) will help do this. An IPMP is very important to the successful completion of the feasibility study, as is a focus on quality.

BACKGROUND

In my job, I review a lot of reports, mostly feasibility reports and General Design Memorandums. I also review many draft reports and attend numerous feasibility review conferences (FRC). It was much the same thing when I was at the Board of Engineers for Rivers and Harbors and at the Washington Level Review Center. With some authority, I can say that we are not completing studies on time and within budget. Why? There are many reasons, including:

- Lack of attention to details.
- Changes in policies and priorities during the study.
- Not taking project management seriously.
- Inexperienced people developing the IPMP.
- Lack of cooperation of various parties on the study.
- Bad luck.
- Only looking at things that support the project, rather than what needs to be done to show that the project is the correct solution.
- Uncertainties not taken into account in the IPMP.
- Changes in conditions during the study.

We can not address all of these things at this workshop. However, we can focus on some - those relating to making the Initial Project Management Plan (IPMP) better. These

---

[1] Assistant Deputy for Planning Policy and Legislation, Office of the Assistant Secretary of the Army (Civil Works)

would be: good project management, paying attention to details, taking uncertainties into account, planning for unbiased evaluations, and cooperating with each other.

GENERAL ACCOUNTING OFFICE REPORT

I would like to present some information from a General Accounting Office report (GAO, 1991), which surveyed non-Federal sponsors to obtain their views on implementation of cost sharing under the Water Resources Development Act of 1986 (PL 99-662). As you know, WRDA 1986 was landmark water resources legislation that reopened the door for the authorization of water resources projects. Among many of its provisions, it requires feasibility studies to be cost shared 50/50 between the Federal Government and a non-Federal sponsor.

The requirement for study cost sharing must be met with nothing less than a total commitment to doing the job on time and within budget. We are more accountable than before WRDA 1986.

In the GAO survey, eighty-three non-Federal sponsors of feasibility studies responded to a series of questions on their relationship with the Corps. There were many responses which reflected very favorably on the work you all do.

- o Eighty-four percent stated they were very satisfied with their relationship with the Corps during the study.
- o Eighty-seven percent stated they had a significant impact on key decisions during the study.
- o Ninety-five percent stated the Corps responded promptly to request for information during the study.

While this is great, and reflects well on the Corps sense of cooperation, there were several other questions which shed light on the study cost and schedule for completion of the studies.

Two questions related to aspects of the feasibility cost sharing agreement that caused the local sponsor concern. Sixty-two (75%) of the sponsors had concerns. Twenty items were listed as possible concerns, ranging from costs, scope of work, language in the agreement, up front financing, etc. Of the 83 responses, there were 256 items checked. An average of three concerns per sponsor.

- o Forty-two (50%) were concerned about high total study costs.
- o Twenty-eight (34%) were concerned with changes in the feasibility study cost estimate.
- o Twenty-one (25%) were concerned with the scope of the study.

- Fifteen (18%) were concerned with the level of work required to meet all the Federal requirements.

Two questions related to the amount of time taken for feasibility studies. Forty-two (50%) of the sponsors had some problems with the length of time for the study. Fourteen items were listed as possible concerns, ranging from change in the scope of work, turnover in Corps staff, cost exceeding agreed upon budget, etc. Of the 83 responses, there were 155 items checked. An average of almost two concerns per sponsor.

- Fifteen (18%) said the scope of work increased.
- Nineteen (23%) said the study cost exceed the agreed upon amount.
- Seventeen (20%) said more time was needed in the feasibility study than agreed upon.
- Twenty (24%) said more time will be needed to complete the total project than expected.
- Ten (12%) said more time will be needed to complete the total project that necessary.

Many of these items indicate the high expectations of the non-Federal sponsor. Were the sponsor's expectations raised to high?

It is very important not to raise the sponsor's expectations to unrealistic levels. Don't understate either the amount of funds or time needed to complete the study.

As an example, we recently had a feasibility review conference where it was reported that the study costs were raised three times since the start of the study. The sponsor was justifiably concerned that the comments on the draft report, and discussed at the conference, would raise them again. This is not good for the creditability of the Corps.

I believe that a good IPMP, outlining what really needs to be done in the study, will minimize these types of problems.

FEASIBILITY REVIEW CONFERENCES

A feasibility review conference (FRC) is very critical to the successful completion of a feasibility study. It must be factored into the IPMP. It is a mandatory meeting, and is the single most important meeting in the study. Take it seriously. You will have a successful FRC if you have:

- Early concurrent review by the Division, HQUSACE, WLRC, BERH, and OASA(CW).
- An objective, non-accusatory, non-defensive meeting with a good facilitator.

All significant aspects of the problem, without project condition, and project (size, features, costs, benefits, NED plan, impacts, etc.) should be identified and discussed at the FRC. There should not be any "stove pipe" or separate meetings before the FRC. If circumstances dictate that there must be separate meetings, then the results and agreements reached at those meetings must be discussed at the FRC. However, you should not commit to making changes before those items are discussed at the FRC, and guidance provided in the Planning Guidance Memorandum (PGM).

In addition, unless they are directions given in the PGM, there should not be any major changes in hydrology, hydraulics, benefits, plan formulation, or cost sharing after the FRC. You should not add new benefit categories after the FRC, unless they are reviewed at the Washington level.

In developing the IPMP, you should anticipate that you might have to do more studies. While it would be nice not to do more studies, the reality is that you will. Anticipate it.

We should learn from past experiences? How? Look at the track record of your district. Check on past FRC conferences. Look at the Washington level comments and the Planning Guidance Memorandum (PGM). Those documents will tell you what you should do in the study, or at least indicate what comments you might get on the draft report. Include the possibility of having comments in the IPMP. Plan ahead and allow for time and money.

In addition, if you want to have a successful FRC, and minimize the possibility of new concerns on the final report, have the FRC as early in the study as possible. Also submit the draft report or FRC documentation to HQUSACE early. Give the Washington reviewers time to do their job. That way it is easier for all of us to work together to correct any problems which might arise.

REPORT REVIEWS

Early and concurrent Washington level review is another important part of the feasibility study process. The Washington Level Review Center (WLRC) functions as the central element in feasibility study reviews at the Washington level. The WLRC is responsible for insuring a comprehensive review of the reports and will perform the detailed review of the policy, plan formulation, cost sharing, economic, and environmental aspects of the project. The review of design, hydraulics and hydrology, legal, and real estate aspects is performed by HQUSACE.

WLRC provides information to assist the Board of Engineers for Rivers and Harbors (BERH), HQUSACE, OASA(CW) and the Office of Management and Budget (OMB) in their decisions. However, remember that WLRC is not a decision maker. Each of the Washington level echelons retains its decision-making responsibilities after the review has been completed by WLRC.

The time needed for the review and time needed to answer questions should be accounted for in the IPMP. You also need to account for unknowns and uncertainties in addressing the comments.

How much time should be allowed to address the concerns? What schedule does the WLRC follow in coordinating the comments and responses? Do you know? If not, find out. WLRC has a schedule for each major step in the review process. They also keep a record on the time it takes for the field to respond to the comments.

OFFICE OF MANAGEMENT AND BUDGET

On September 17, 1981, President Reagan signed Executive Order 12322, which required that before any agency submits a report or plan to the Congress for approval, authorization, appropriation, or legislative action that they first must submit the report to the Office of Management and Budget for review. The OMB advises Army on the consistency and relationship of the project with:

- Policy and programs of the President.
- Principles and Standards for Water and Related Land Resources Planning.
- Other applicable laws, regulations, and requirements relevant to the planning process.

As you can see, OMB is responsible for a comprehensive review. Many people do not know this. A review by OMB is critical. We need clearance before Army can recommend authorization of a project for construction, or develop an Administration position on a water resources development bill. We should strive to obtain a favorable Administration position since it makes future funding much easier. We want to recommend for authorization those projects that we would support funding for construction.

We have, within the past two years, initiated a process of involving OMB more in the Washington level review. We are striving to have OMB rely on the results of the Washington level review in its evaluations. Although OMB has not committed to being involved in the Corps' concurrent review process, they are invited to the Senior Representatives meetings. They obtain copies of the PGM, the Washington level review comments and field responses to the comments. In addition, OASA(CW) holds a briefing for OMB on each project. This is proving very beneficial for the Corps.

SUMMARY

One idea you should keep in mind in your work is "QUALITY". You should apply this idea in your job every day. Quality is what we all want when we buy things. Right? Many companies advertize the quality of their product. Why not the Corps? If we do, we will get the job done on time and within budget.

REFERENCES

GAO, 1991. WATER RESOURCES: Local Sponsors' Views on Corps' Implementation of Project Cost Sharing. United States General Accounting Office (GAO/RCED-92-11FS, November 1991).

THE INITIAL PROJECT MANAGEMENT PLAN AND WASHINGTON LEVEL REVIEW OF FEASIBILITY REPORTS

by

Arthur J. Klingerman[1]

I have two objectives for this paper. My first objective is to answer the questions, what is the Washington Level Review Center (WLRC), and what does it do? My purpose is to identify WLRC's perspective, or point of view, within the Washington level review and approval process. My second objective is to identify some of the more common review concerns that arise during Washington level review of final feasibility reports. I hope that this information will help you focus attention on these potental issues as you prepare IPMP's. Since WLRC's principal focus is policy and planning review, I will focus on concerns involving economic and environmental evaluation, and plan formulation.

WHAT IS WLRC AND WHAT DOES IT DO?

WLRC was created in late 1988 as a direct result of an initiative to streamline the Washington level review process. The existing staff of the Board of Engineers for Rivers and Harbors (BERH), except for four advisors to the Board, was transferred to WLRC. The planning and policy detailed review functions were transferred to WLRC from HQUSACE. Also, for about the last year and one-half WLRC has done detailed cost estimate review. WLRC reviews these aspects of feasibility reports, post authorization change reports, detailed project reports where approval authority has not been delegated, General Design Memoranda, and other decision documents that the Director of Civil Works may request. In addition to its technical review responsibilities, WLRC has been given the reponsibility to manage the Washington level review of feasibility reports required by the Board of Engineers for Rivers and Harbors (BERH), the Chief of Engineers, and the Assistant Secretary of the Army for Civil Works (ASA(CW)). The management of the review of reports other than feasibility reports remains the responsibility of either Policy and Planning Division or Engineering Division in headquarters. Attached is a schematic and description of the concurrent Washington level review process for feasibility reports recommending project authorization.

As shown on the schematic there are several headquarters participants on the Washington level feasibility report review team. Engineering division review is conducted by several technical branches. Their review is coordinated, and views represented, by General Engineering Branch. BERH staff and ASA(CW) staff also participate in the review process. The Board of Engineers for Rivers and Harbors, the Chief of Engineers, and the Assistant Secretary of the Army for Civil Works participate in the decisionmaking portion of the process. Additionally, while not active participants in the review, the Office of Management

[1]Chief, Management and Review Division, Washington Level Review Center.

and Budget (OMB) staff sometimes participates in discussions during the late stages of the review process in preparation for their decision-making.

In summary, the WLRC perspective in the review of feasibility reports is that of the technical policy/planning reviewer and the organization responsible to see that the questions and concerns of other participants are answered. From WLRC's view, success is a feasibility report that gains the approval of ALL of the Washington level decisionmakers.

RECENT SIGNIFICANT REPORT REVIEW CONCERNS

In preparation for this presentation I asked the WLRC review staff to identify the most common concerns that had arisen in feasibility reports during the last couple years. The most significant, in my view, follow.

<u>The Without-Project Condition</u>. The most common review concern is the lack of support for the without-project condition. Since the economic benefits needed to support the recommended plan are represented by the difference in outputs between the recommended plan and the without-project condition it is essential that the without-project condition be well thought out and defensible. The report should contain an analysis and discussion of what presently exists, how the situation will change in the future, the causes of change, and support for the economic forecasts and projections. In cases where significant economic benefits are based on future growth, detailed support for the projected growth is needed.

Similarly, many environmental documents use <u>existing</u> conditions as the basis for determining project impacts. Impact assessment and mitigation should be based on comparison of the with- and without-project conditions over the life of the project.

<u>Evaluation of Alternatives</u>. Sufficient information is not always provided in the report to demonstrate that the costs and benefits of the viable alternatives have been fully evaluated. This is needed to identify the NED plan, support the selection of the recommended plan, and determine the appropriate cost sharing. These are important factors that go beyond "academic" planning interest. In particular, cost sharing decisions directly affect the non-Federal sponsors pocket and relationship with the Corps.

Similarly, some recent reports have not contained sufficient information to demonstrate that the economic concepts of incremental analysis have been properly applied or separable elements properly identified.

<u>Plan Selection</u>. Remember, when there are two or more alternatives for which net benefits are nearly the same, current Army policy is to recommend the lower cost alternative unless there are significant reasons to do otherwise.

<u>Incremental Analysis of Mitigation</u>. There is a general lack of understanding of incremental analysis in mitigation planning. Frequently, reports do not contain the required analyses or contain incorrect analyses.

Justification of Mitigation. Frequently, reports do not adequately describe the significance of environmental resources to be impacted by the project. Once the significant resources are clearly defined, impacts and mitigation for these significant resources should be discussed in detail.

Coordination/Documentation. The NEPA documents often fail to document that study results have been properly coordinated with appropriate agencies; for example, coordination with the U.S. Fish and Wildlife Service and National Marine Fisheries Service under Section 7 of the Endangered Species Act. In most cases, WLRC review reveals that coordination has occurred even though it had not been documented in the report. Additionally, the scoping process should be more completely described. The NEPA documents should clearly demonstrate that the proposed project is in full compliance with Corps regulations implementing environmental laws and Executive Orders.

THE IPMP AS A TOOL FOR PREPARING SUCCESSFUL FEASIBILITY REPORTS

The IPMP is the roadmap for the feasibility stage. As such it is the vehicle that identifies studies needed to select and support the appropriate recommended action. It also identifies when the needed studies are to be accomplished. If the planning process is to lead to a successful feasibility report it is important that the the preparers of the IPMP recognize that it is as important to identify and describe why the decisions leading to plan selection were made as it is to describe the components of the selected plan. Studies to address these issues need to be progammed into the study process. To minimize report review and processing time and the risk that important aspects of the recommended plan will change after the local sponsor has "bought off" on the proposal, it is important that potential planning and policy issues are discussed during IPMP development. Studies addressing these issues should be scheduled as early as practical to avoid last minute surprises.

REVIEW PROCESS - FINAL FEASIBILITY REPORT

1. **Report submittal.** District Engineer submits completed feasibility report, engineering appendix, PMP, M-CACES cost estimate, and supporting documentation to Division Engineer.

2. **Report concurrence.** Division Engineer verifies compliance with the PGM, issues Division Engineer's Public Notice, and endorses report to Washington Level Review Center (WLRC) for initiation of concurrent Washington level review. Copies of report are provided to Assistant Secretary of the Army (ASA(CW)) and U.S. Army Corps of Engineers Headquarters (HQUSACE) Policy and Planning Division (CECW-P).

3. **Initiation of review.**

   a. WLRC review manager distributes report to review team members within WLRC and team members in HQUSACE Engineering Division (CECW-E), Operations, Construction and Readiness Division (CECW-O), Project Management Division (CECW-L), Directorate of Real Estate (CERE), and Office of the Chief Counsel (CECC) with request for comments. Report is provided to staff of the Board of Engineers for Rivers and Harbors (BERH).

   b. Concurrently, WLRC review team members evaluate report adequacy for initiation of 90 day state and Federal agency review. The target for initiation is 5 days from receipt of report.

4. **Review team comments.** Review comments are forwarded to WLRC review manager by review team members. The target date for receipt of comments is 4 weeks from receipt of report by WLRC.

5. **WLRC/HQUSACE Review Team Assessment.** The review manager prepares and forwards the WLRC/HQUSACE review Team Assessment to BERH staff and ASA(CW) staff for their concurrence or incorporation of additional comments. Copies of the team assessment are also sent to submitting district and division. The target for forwarding the team assessment to BERH and ASA(CW) staffs is 2 weeks from receipt of team comments.

6. **BERH and ASA(CW) concurrence.** Concurrence or additional comments are provided by BERH and ASA(CW) staffs. The target date for receipt of comments is 3 weeks from receipt of review team assessment.

7. **Washington Level Final Assessment.** The review manager prepares and forwards the Washington Level Final Assessment to the submitting division. Copies are sent to the submitting district, BERH, ASA(CW), CECW-P, all HQUSACE review team members, and The

Office of Management and Budget (OMB). The target for completion is 1 week after receipt of BERH and ASA(CW) staff concurrence or comments.

8. The division forwards the Washington Level Final Assessment to the district for response.

9. **Washington Level Review Conference.** The WLRC review manager arranges a conference and site visit between district, division and WLRC/HQUSACE review team to discuss the Washington level comments. The target date for the conference is 1 week after completion of the Washington Level Final Assessment.

10. **Briefing for Designated Senior Representatives of Decisionmakers.**

a. The submitting division responds to comments in the Washington level final assessment. The target for receipt of responses from the division is 4 weeks after the Washington Level Review Conference.

b. After consideration of responses, the WLRC review manager completes the Project Review Summary and Documentation of Review Findings and forwards them to BERH and ASA(CW) staffs and the Director of Civil Works (DCW). Copies are also sent to OMB, CECW-P, HQUSACE review team members, the staffs of all BERH members, and the submitting division and district. The Project Review Summary briefly describes the report content, responses to the Division Engineer's Public Notice and state and Federal Agency review, significant review concerns, and suggested topics for consideration by decisionmakers. The Documentation of Review Findings documents all comments in the Washington Level Final Assessment, division responses, and WLRC/HQUSACE review team assessment of the adequacy of the responses. Completion of the review summary and documentation is targeted for 2 weeks after receipt of responses to Washington level comments.

c. A briefing for designated senior representatives of the three decisionmakers (BERH, Chief of Engineers, and ASA(CW)) is held to facilitate discussion of the review findings with the WLRC/HQUSACE review team. OMB participation is invited. District and division representatives normally attend. The briefing is targeted for 1 week after distribution of the project review summary and documentation.

11. **Decision process.**

a. The Board of Engineers for Rivers and Harbors meets to formulate its recommendation to the Chief of Engineers. BERH action is targeted for 3 weeks after the briefing for designated senior representatives of decisionmakers.

b. The Chief of Engineers transmits his final report to ASA(CW). This is targeted for 3 weeks after BERH action.

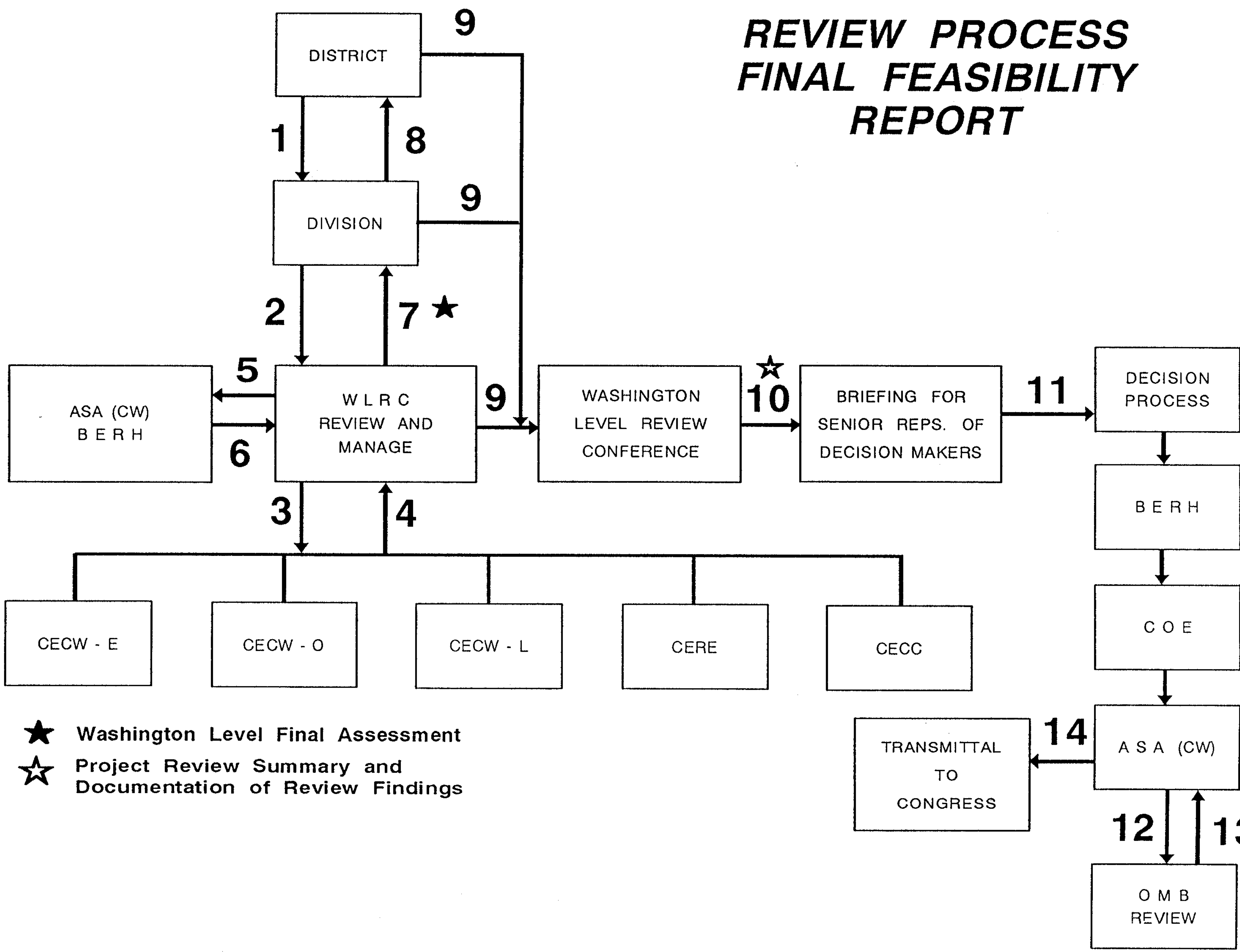
c. ASA(CW) formulates position.

12. **OMB review.** ASA(CW) requests OMB position on project authorization. The target for this action is 2 weeks after issuance of Chief's report. The total target time for the concurrent Washington level review to this point is 26 weeks.

13. **OMB clearance.** OMB advises ASA(CW) of Administration position on project authorization and clears feasibility report for transmittal to Congress.

14. **Transmittal to Congress.** Upon receipt of OMB clearance, ASA(CW) forwards the recommendation regarding authorization to Congress along with the report of the Chief of Engineers, the feasibility report, the BERH report, and the responses to the state and Federal agency review.

REVIEW PROCESS FINAL FEASIBILITY REPORT



★ Washington Level Final Assessment

☆ Project Review Summary and Documentation of Review Findings

IMPACT OF ENGINEERING INPUT ON IPMP'S

by

Philip M. Brown, PE[1]

INTRODUCTION

In keeping with the implementation of project management, seamless funding, and the elimination of GDM's, all engineering technical functions are now having to work very closely with the planning functions in the formulation and project authorization, and with the Project Managers, who will control and assign funds to the functional elements having design responsibility.

Consequently, in an effort to make life cycle project management work, roles and responsibilities of deputy district engineer for project management, functional chiefs, project managers, and technical managers have been written and approved by the steering committee for the implementation of project management. Recently published in EC 5-1-48, Implementation of Project Management, and currently scheduled to be published this month as an ER.

Under these new processes a typical Corps project should have a development time of approximately seven years. This period consists of one year for a reconnaissance study, four years for the feasibility phase study, and two years for preconstruction engineering and design (PED). The feasibility report with an engineering appendix will contain a baseline cost estimate on which project authorization will be based. The engineering activities performed during the feasibility phase must be of sufficient depth to enable the project to survive PED without the need for reformulation. The project's baseline cost estimate must not exceed the 20% limit set be Section 902 of WRDA'86. These are the basic guidelines with which we are operating today, and the IPMP is the tool utilized to accomplish these objectives. In addition, the IPMP identifies the engineering level of detail necessary to establish project features and the construction schedule.

POLICY

The engineering development of all civil works projects will follow the requirements as laid out in the revised ER 1110-2-1150 to be published soon. The Engineering Division will have a profound impact in all phases of project development. The first two phases are Recon and Feasibility. Engineering impact here is much more significant than it used to be.

---

[1]Chief, Eastern Section, General Engineering Branch, Engineering Division, Directorate of Civil Works, Washington, D.C.

RECONNAISSANCE PHASE

(A recon study is conducted to determine if the problem has a solution acceptable to local interests and if there is a Federal interest.) It should not take more than 12 months (or 18 months under unusual circumstances.) It should be of minimal cost and effort however sufficient to develop a plan showing the problem has a possible solution.

The engineering effort will consist of:

- preparing and reviewing proposed project features

- structuring the project features to coincide with the Code of Accounts structured format

- develop preliminary cost estimates

- develop preliminary construction schedule

- participate in any TRC's and RRC's (TRC should be several days/weeks prior to RRC - this will enable technical issues to be resolved for the RRC - involve division and HQ)

- Finally and most importantly we need to develop the engineering effort and budget (by function) required for the Feasibility Phase which will be used to develop the IPMP. **(IMPORTANT - MUST BE INVOLVED IN DEVELOPMENT OF IPMP - BE ASSERTIVE IN GETTING REQUIRED ENGINEERING STUDIES NECESSARY TO PREPARE AN APPROPRIATE ENGINEERING APPENDIX.)**

DISTRICT/DIVISION ENGINEER'S CHECKLIST FOR RECONNAISSANCE PHASE

- <u>Was the TRC held? If so, are all technical issues resolved</u> considering the limit of effort involved? Non-complex projects may not require a TRC separate from RRC. This a decision that engineering should make.

- <u>Was the IPMP developed by and fully coordinated with all technical functional elements?</u> The Technical Managers, in coordination with the functional branch chiefs, must work closely with the PM in this process.

- <u>Does the IPMP adequately address the engineering level of detail?</u> Since the Feasibility Study costs are cost shared 50-50 with the sponsor, there may be pressure from other directions to suppress the amount of engineering studies, consequently lower feasibility costs. We should resist to the point that we have a warm and comfortable feeling that we will be able to develop the project features and cost estimate that will withstand self imposed cost and schedule limits.

- <u>Has there been a full and adequate review of the recon report?</u>

- <u>Does the Chief, Engineering Division fully endorse the report?</u> It the technical managers responsibility to provide your chief with this confidence.

FEASIBILITY PHASE

(A feasibility study is conducted to investigate and recommend a solution to the problem and to develop a baseline cost estimate and implementation schedule which are the basis for Congressional authorization.) The feasibility study is to be cost shared 50-50 % with the local sponsor, and should be completed within four(4) years, based on the complexity of the project. The purpose is to allow the project to survive PED activities without need for reformulation, GDM, or a PAC.

The Engineering effort will:

- verify the level of detail of the engineering studies and field investigations which were previously established in the IPMP.

- conduct a technical evaluation of viable alternatives. Withdraw those not deemed appropriate with concurrance of Project Management and Planning functions.

- technically refine the project features of the selected alternative.

- prepare estimate in M-CACES format for initial project construction cost as input to the baseline cost estimate and the project formulation process.

- develop a design and construction schedule. The design schedule should show detailed design to begin immediately following receipt of PED funds. Include costs for each aspect of design.

- provide support to the PM in developing the PMP.

- although planning has the responsibility of the report, the engineering division is responsible for the engineering appendix to the feasibility report to include: H&H, surveying & mapping, geotechnical, structures, real estate, project design, etc. Operability and maintenance are also to be considered in studies and design. (I consider this appendix a sub-product to the main product feasibility report.)

- support the draft LCA preparation. This draft will be included in the feasibility report. Engineering's main concern/interest is the project description and costs.

- review feasibility report for all technical aspects. Key elements that HQ(CECW-E) will look for are:

  * conformance to current criteria for H&H.
  * adequacy of subsurface investigations
  * soundness of design to allow project to perform.
  * reasonableness of constructability and sequence.
  * impacts of failure and proposed measures to minimize.
  * measures to minimize catastrophic event impacts.
  * reasonableness of unit quantities & contingencies.
  * assurances that analysis have been checked.
  * aesthetic considerations.
  * identification of tradeoffs between risks & costs.

DISTRICT/DIVISION ENGINEER'S CHECKLIST FOR FEASIBILITY PHASE

- <u>Is the TRC scheduled prior to the FRC?</u> Projects having complex problems should have a technical meeting in advance of the FRC. Too many times we've gone into FRC's with unresolved technical issues.

- <u>Are remaining technical issues resolved at the FRC?</u>

- <u>Is PGM complied with in the final report?</u> The PGM is a good place to give decision guidance for GDM waiver.

- <u>Feasibility report must have an engineering appendix?</u>

CONCLUSION:

With the implementation of Project Management, to insure a strong effective partership with all the internal Corps functional elements at all levels of management, and especially the Local Sponsor, the engineering community must be willing to participate effectively in all phases of planning, design and construction, especially the IPMP development, to produce a quality product within budget and on schedule.

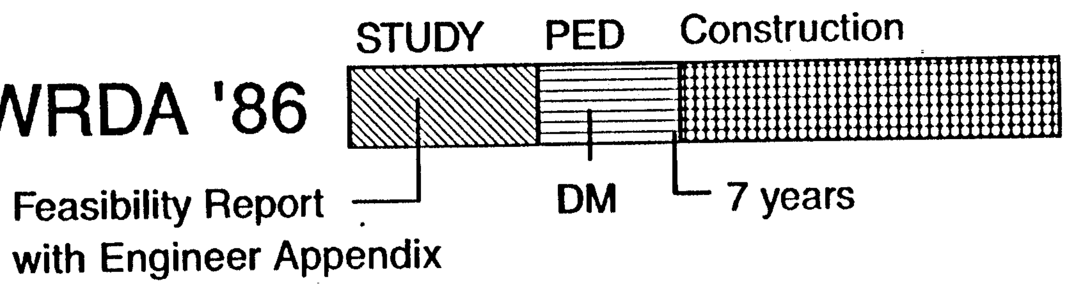
The new ER 1110-2-1150 will elaborate much more on what was just covered including outlines, content, and format of both engineering appendix to the feasibility report, DM's, GDM's (if req'd), and table showing approval level of all documents.

Project Phases

Pre-1983

-- Due to Time Gap, Changed Conditions, etc, GDM Necessary to Reaffirm Project Formulation

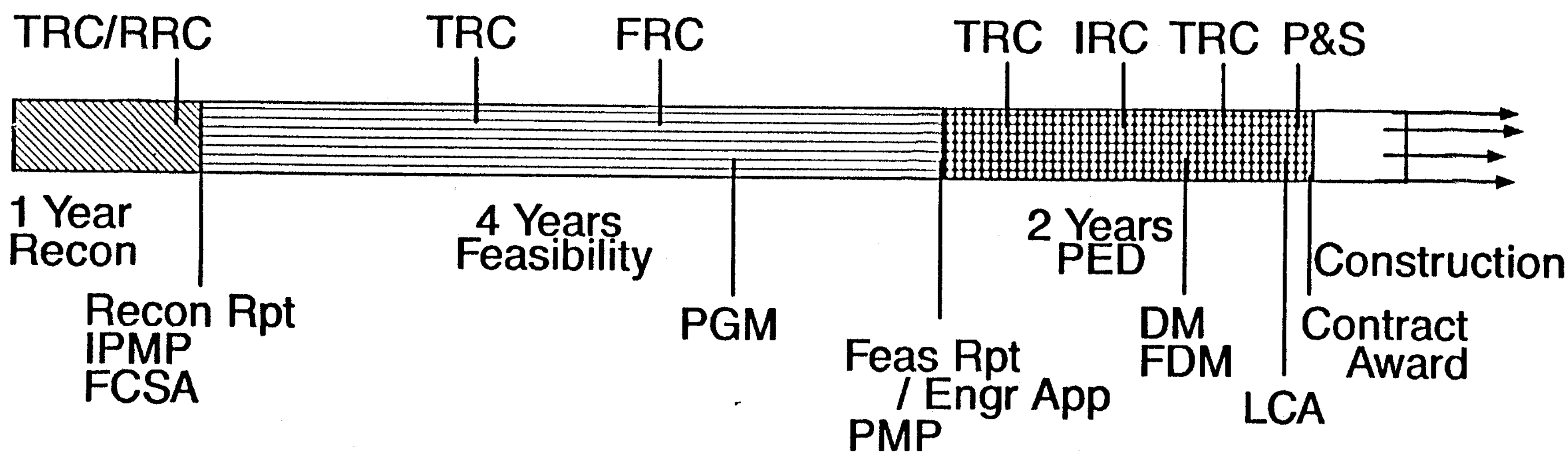
WRDA '86



-- Greater Level of Engineering Detail

-- No GDM Required if Project Remains as Formulated

Engineering Milestones



TRC - Technical Review Conference
RRC - Reconnaissance Review Conference
IPMP - Initial Project Management Plan
FRC - Feasibility Review Conference
PGM - Project Guidance Memorandum
PMP - Project Management Plan

IRC - Issue Resolution Conference
P&S - Plans and Specifications
PED - Preconstruction Engineering & Design
FCSA - Feasibility Cost Sharing Agreement
DM - Design Memorandum
FDM - Feature Design Memorandum

IMPACTS OF DISTRICT PARADIGMS ON IPMP's

by

Lewis A. Smith[1]

INTRODUCTION

IPMP's have been a concern of mine for years. Way back when PMP meant only PROBABLE MAXIMUM PRECIPITATION and feasibility reports were prepared, review questions were ignored and the "real" project was planned and designed in the GDM. This era was a very busy time for many districts. The work effort was often broken into pieces to be completed by specialists. Supposedly, this was efficient. Our organizational structure still reflects the practices of that era. Additionally, our attitudes about study efficiency still prevail in many places. Piece work assignments are still the norm in many districts today. But others do things differently. Some are effective at getting products developed and approved but others invariably need extra time and money after reviews. This paper is about those differences, some corrective actions to help IPMP usage and advice to help implement any changes to improve IPMP usage.

THE PROBLEM

As a HQ's reviewer for over a decade, I have been to almost every district and many districts a multitude of times. All districts have similar functions although sometimes in different organizational arrangements. All have their own corporate personality partly reflective of the division corporate personality. But I believe some of these corporate personalities are much more effective than others at selling their designs. Timely responses which answer or resolve reviewer's concerns is my measure of effective selling. (This is not a reflection of used car salesperson experience or a cram course on how to con the reviewers.)

An effective district personality, from my observations, appears to establish study teams which communicate well among themselves, collectively make most project decisions and actively use reviewers for advice and counsel. For the less effective districts, communications among themselves can be observed as them-and-us in tone and with few study team project decisions. A similar tone for reviewers is evident but more polite. Review comments are often viewed as adversarial and ignored when possible. Formulation, design, cost and schedule blunders occur frequently with their projects.

In project meetings, I've observed differences in districts. We all speak English with professional conduct and tone. All meetings have individuals with excellent communication skills. The difference is not in what or how words are used but in a faulty corporate mental

---

[1]Hydraulic Engineer, Hydrology Section, H&H Branch, CECW-EH-Y, US Army Corps of Engineers, Washington, DC.

model, or **PARADIGM,** of the district staff roles and their role in the review process. Specifically, problems center on the roles of the study team members and reviewers.

To me, a poor district paradigm adversely impacts study processes and products. Early indicators of impacts can be gauged in the IPMP. A computer spitting out reams of analysis from faulty data will cause costly blunders in design. Similarly, an IPMP can be prepared with faulty mental models about 1) selection of project features, 2) timing of design work, 3) working relations, 4) team player roles, 5) work assignment methods, 6) quality, 7) innovation, 8) reviewers, and 9) the review process. These faults will give IPMP's which will cause draft feasibility reports at the FRC with 1) costly additions of work needed to complete the report, 2) contain blunders in formulation, design or workability, 3) reflect lack of innovation, 4) have difficulty applying new procedures from guidance and 5) often create adversarial dialogues with reviewers.

CORRECTIVE ACTIONS

Those are my subjective observations on the problems. Now the corrective actions. The following questions identify two paradigms for corporate personalities in districts. The first part is a faulty paradigm, "- or -" and the second part a replacement paradigm. All of these paradigms can be changed in a district by individuals and eventually corporately. I believe the use of the replacement paradigm should give better IPMP's; yield more cost effective, better quality projects; fewer and less costly review responses; and foster better, more effective communications within study teams to sell designs to reviewers. So let's go!

How do you and your District stack up on these questions?

<u>GROUP</u>	<u>FAULTY PARADIGM - OR - REPLACEMENT PARADIGM</u>
a	Who selects the alternates for evaluation in feasibility: the planning PM - or - the collective insights of the team?
a	When are the "real" alternates and their ranges identified: after - or - before the IPMP?
a	When do you decide about the gross work effort in the PMP (I do not mean IPMP): feasibility - or - recon?
b	Is the IPMP a planning document with others input - or - is the IPMP a realistic document reflective of team needs?
b	Is the development of the IPMP cost estimate a haggling game between PM's and support elements - or - is it a team negotiation process for necessary products within resource limits?
b	Is the IPMP treated only as a HQ's reporting requirement - or - is the IPMP a useful district management tool which continues to "live" during the study and help make resource allocation decisions?

b Is the cost estimate skewed to pay salaries of select groups within the district - or - allocated for resource needs in studies?

c Are assignments for analyses and products made by "piece-work DF's" from the PM - or - by team member initiatives within resource limits?

c Are study teams a convenient group for the PM to hold project discussions - or - a co-equal group of professionals making project decisions?

d Is project quality measured only by adherence to guidance and schedules - or - by effective efforts to answer or resolve project performance and project impact questions?

d Do reviewers cause problems during the processing of reports for approval - or - do they help on policy hurdles, national perspectives and technical insights?

d Do reviewers hassle project innovation - or - can reviewers help innovation?

d Does innovation have too many "review risks" to ever try something - or - are review risks normal for innovation and minimized with effective stove pipe discussions?

Well, have you got problems or did you do good?

Most of these questions have come from my reviews and the others are perceptions I have tried to correct in my dialogues with districts. Groups a, b and c can have cost, schedule and project formulation impacts. Group d has less obvious impacts. Group a (who & when alternates are selected plus design timing) can add significant uncertainty in either direction to time and cost estimates. Group b (attitudes in preparing IPMP's) can foster them-and-us dialogues. It can also short change project performance studies which may cause review problems later. Group c (work assignments and use of study teams) often lead to blunders in formulation for project performance, in design and in subsequent MCACES estimates. Lastly, Group d (quality and reviewers) can ignore needed studies and potential help and advice to get products thru system.

IMPLEMENTATION

Implementing the actions can be a problem also and will take additional effort. The easy way to implement these is to simply adopt the second part of each paradigm at the corporate level in the district and get individuals to buy into the changes. But, I'm doubtful of the ease of this. Selling the concept to district management for adoption needs to first identify study management problems, like: significant review comments directed at basic formulation, performance, design or workability issues; answers to review questions which take extensive restudy; district debate and finger pointing about who-did-what; extensive paper chases on resolution of review comments; too much internal district memos for work assignments and schedule adherence; and persistent adversarial dialogues during the review process. The second step is to identify potential improvements from changes, like: decreased product costs; fewer redos and further studies at the end; and selling designs easier to reviewers to gain approvals. Next, change performance standards and appraisals for supervisors and team members to apply the replacement paradigms. And finally, management must expect and allow project decisions to be made by the study team.

However, the corporate personality may resist your proposal. But you still have an option. If you believe in the replacement paradigms, you as a professional can practice and preach the sermon. I've been doing some of the practicing and preaching approach about study plans (IPMP's), innovation and getting reviewers involved early in studies for years. Much progress has been made in the 90's, but help is always needed and appreciated!

ACKNOWLEDGEMENTS

Harry Kitch for content and editorial advice, Dick DiBuono and Mike Smith for editorial corrections, and Tom Munsey for reading the paper. Col. Hugh Boyd for a past District Commanders concurrence in these observations. Paul Barber, as a chief of engineering, encouragement to go with it. And finally, to my many field colleagues answering my funny questions over the last year, thank you all.

SUMMARY OF SESSION 2: CASE STUDIES

OVERVIEW

This session includes six papers and one panel discussion. The papers consisted of case studies on the development and utilization of IPMP's. The panel discussion focused on using IPMP's as a living document.

PAPER PRESENTATIONS

Paper 5. Linda Hendricks, Project Manager, Nashville District, presented a paper entitled "The Importance of Reconnaissance Level Investigations in the IPMP Process." The main objective of the paper was to emphasize the importance of the reconnaissance phase in providing good data from which to develop the IPMP. The Chattanooga area reconnaissance effort was presented as a case study. The authors discuss several "Lessons Learned" during the conduct of the case study.

Paper 6. Jerry W. Webb, Chief, Hydrology Section, Huntington District, presented a paper entitled "Importance of the Study Team." Jerry emphasized the importance of the study team to the success of a project. The characteristics of effective and ineffective teams were outlined. Jerry went on to discuss the proper way to build a good study team. The role of the project manager in motivating the team was stressed. Several comparisons were made between how studies are performed in the private sector and the Corps. Jerry discussed several examples of how the team concept was either successful or not successful in studies that have been performed in the Corps.

Paper 7. Robert Elkin, Physical Scientist, Detroit District, presented a paper entitled "Milwaukee Metropolitan Area, Wisconsin Flood Control Study." Robert began his presentation by discussing what was accomplished in the reconnaissance phase study. Upon completion of the reconnaissance report, the IPMP was developed. Robert's presentation focused on several problems that were encountered after the IPMP was developed.

Paper 8. Patricia Obradovich, Economics Section, Portland District, presented a paper entitled "The Development of the Johnson Creek EMP." This presentation centered around the development of the Economic Management Plan (EMP), which is one of the major components of the IPMP. Specifically, Patricia discussed how they incorporated two new pieces of guidance into the development of the EMP. These two new pieces of guidance included the generic EMP (Wilbanks, 1992) and the risk and uncertainty EC.

Paper 9. Gary R. Dyhouse, Chief, Hydrology Section, St. Louis District, presented a paper entitled "Hydrologic Engineering for the IPMP." Gary discussed how to develop the Hydrologic Engineering Management Plan (HEMP), which is a major component of the IPMP. Gary outlined the major steps involved in developing the HEMP and the time and cost estimate. Gary went on to discuss many of the problems that lead to budgeting difficulties in hydrologic studies. Gary's presentation and paper have examples of an initial HEMP and hydrologic engineering time and cost estimates.

PANEL 2: USING IPMP'S AS A LIVING DOCUMENT

Four panel members made short presentations based on their individual experiences with using IPMP's during feasibility studies.

a. James F. Robinson, Assistant Director, Programs and Project Management, South Atlantic Division, presented a paper entitled "Using IPMP's as a Living Document, the Manager's Viewpoint." James started his presentation with a review of how the IPMP is developed. The major components of what is included, who is involved and how to coordinate were reviewed. James emphasized that the experience of senior staff members is extremely important when developing the IPMP. James went on to discuss how the IPMP is utilized during the feasibility study. An important point made by James was that changes to the IPMP will often occur during the feasibility study. He discussed how to handle making changes to the IPMP and the FCSA (Federal Cost Shared Agreement).

b. Lauren Renning, Project Manager, Sacramento District, presented a paper entitled "Trouble Shooting with a Management Plan." Lauren's presentation focused on how to effectively solve problems by incorporating specific trouble shooting tools into the IPMP. Specifically, she discussed the use of contingencies, task-to-task relationships, and change management plans. She went on to describe how these tools can be incorporated into the IPMP. She also gave several examples of how this was accomplished in projects she has been involved.

c. Daniel K. Harvey, Chief, Hydrology Section, Seattle District, presented a paper entitled "IPMP's - Matrix Analysis for Alternative Selection." Dan's presentation focused on how to effectively narrow down the number of potential project alternatives that can realistically be examined in the feasibility phase study. This is a common problem that must be addressed before developing the IPMP. Dan presented an effective matrix evaluation methodology that was used on the Lake Washington Ship Canal project. This methodology allowed them to reduce the number of alternatives that were evaluated in feasibility, and thus reduced the cost and time to complete the study.

d. Ken S. Cooper, Chief, Planning Division, Omaha District, presented a paper entitled "IPMP: A Flexible Tool." The main focus of Ken's presentation was to stress that the IPMP should be used as flexible tool. Changes to the IPMP are almost always necessary to adjust for evolving requirements and to react to knowledge gained as the study progresses. Ken pointed out that the main objective should be a complete feasibility report, not an IPMP that remained static throughout the study. Ken also discussed the importance of educating the cost shared partner to the fact that the IPMP will likely evolve as the feasibility study progresses.

PAPER PRESENTATION

Paper 10. William Haines, Cliff Kidd, and Dennis Seibel (respectively: Study Manager, Regional Economist, and Chief, of H&H), Baltimore District, presented a paper entitled "IPMP for Local Flood Protection Project, Petersburg, West Virginia." The Petersburg project was one of the first cost-shared feasibility studies performed by the Corps, and it included both cash and in-kind service contributions from the local cost shared partner. This project was also unique in that it was conducted on a accelerated two year program. The Baltimore District was able to successfully complete the study on time and within budget. Their presentation covered how the IPMP was developed, the application of the IPMP during the feasibility study, and the usefulness of the IPMP from a variety of district perspectives (Economic, H&H and Study Management).

THE IMPORTANCE OF RECONNAISSANCE LEVEL INVESTIGATIONS IN THE IPMP PROCESS

by

Harry Blazek, P.E.[1]
Linda Hendricks[2]
John W. Hunter, P.E.[3]

INTRODUCTION

In recent years the Corps of Engineers has altered the reconnaissance level study process. Changes have resulted in less time and resources to analyze the problems and to establish the Federal interest. An accurate cost estimate of the subsequent study phase is also necessary since local sponsors cost share at the feasibility study level. The Initial Project Management Plan (IPMP) is the required tool for developing schedules and cost estimates and managing feasibility studies, most of which are cost shared. The schedules and costs reflected in the IPMP are based primarily on information developed at the reconnaissance phase. The basic findings of the reconnaissance study, therefore, must be sound to successfully scope the feasibility effort.

This paper is a cooperative effort of the two Hydraulic Engineers and the Study Manager involved in the recent Metropolitan Region of Chattanooga Reconnaissance Study. The authors discuss the importance of details used as base input for the Chattanooga area reconnaissance study and the collective impact these details had on study conclusions. The objective of the paper is to re-emphasize the importance of the reconnaissance phase in providing conclusive baseline data from which to develop the IPMP. Using the Chattanooga area reconnaissance effort as a case study, the authors discuss the need to accomplish timely reconnaissance conclusions based upon accurate data. Lessons learned during the conduct of the case study are highlighted.

PURPOSE OF RECONNAISSANCE LEVEL INVESTIGATIONS

The Corps of Engineers has used the two-stage reconnaissance-feasibility study process since 1982. The primary purpose of the reconnaissance study is to demonstrate the reasonable potential for worthwhile feasibility efforts leading to implementation of Federal projects. In 1986, when PL 99-662 established study cost-sharing at the feasibility level, the effective "weeding" process of the reconnaissance phase became even more important.

---

[1]Hydraulic Engineer, Nashville District, U.S. Army Corps of Engineers

[2]Project Manager, Nashville District, U.S. Army Corps of Engineers

[3]Hydraulic Engineer, Nashville District, U.S. Army Corps of Engineers

During the Fiscal Year 1991 budget passback, the Office of Management and Budget suggested that reconnaissance studies be funded by local sponsors. HQUSACE established a task force to investigate the merit of this proposal. The Office of the Assistant Secretary of the Army for Civil Works (OSA) also contracted an independent survey of the effectiveness of this first study stage. The HQUSACE study recommended retaining the current procedure of a Federally funded reconnaissance report and a cost shared feasibility report. The OSA study concluded the objective of weeding out bad projects early is being met and at reasonable cost. The OSA study further determined that reconnaissance studies too often included an excessive amount of technical detail, analyzed excessive numbers of alternatives, and included too much public involvement.

Subsequent guidance from HQUSACE re-emphasized the critical nature of completing reconnaissance studies within twelve months (and in no case exceeding eighteen months) along with the supporting objective of identifying a Federal interest. Paragraph 2-9e(2) of ER 1105-2-100 (Planning Guidance) directs district commanders to ensure that "experienced and qualified personnel are assigned to the study team". The regulation further states that "many decisions will have to be based solely upon professional judgement without all the desirable information". A conflict exists between the need to gather detailed information and the time and resources available to obtain and process the information to make conclusive decisions. The reconnaissance study must be expeditious yet effective enough to allow for confidence in the scope of the Initial Project Management Plan.

THE ROLE OF THE INITIAL PROJECT MANAGEMENT PLAN

Initial Project Management Plans provide the basic tools to successfully complete feasibility phase studies. A basic project management adage is "Plan the Work; Work the Plan." The foundation or basis of an IPMP (or any plan) is a specific work scope. The work scope essentially describes the tasks necessary to accomplish the plan. Conclusions drawn from the reconnaissance study guide study team members to the specific tasks necessary during the feasibility phase. Critical mapping and detailed hydraulic modeling are generally too expensive or time consuming for the reconnaissance stage, therefore, conclusions must often be based upon <u>experienced</u> judgement.

From a study manager's point of view, the IPMP is his contract with the local sponsor and with the study team to complete the work as detailed. Since the work scope should be very specific, effort must be made in the reconnaissance study to narrow possible alternatives and to define the most promising one.

CASE STUDY

In 1990, a resolution was adopted by the Senate authorizing an investigation of flooding problems in the metropolitan region of Chattanooga, Tennessee. This study was later defined to include Hamilton County (which contains the City of Chattanooga) and two adjacent counties of Catoosa and Walker County, Georgia.

To define the scope of this reconnaissance effort, a study team met with each of the five local government entities involved. From this series of meetings, local officials identified nineteen sites for the Corps of Engineers to evaluate potential flood damage abatement measures. These sites are shown on Figure 1. Each of these sites would typically be studied individually under the Continuing Authorities Program. For this study, however, they were consolidated into a single comprehensive study.

DESCRIPTION OF THE STUDY AREA. Most of the nineteen sites in the Metro Chattanooga study lie within the Tennessee River Valley. Hamilton County is in southeastern Tennessee along the Tennessee-Georgia border. Catoosa and Walker Counties, Georgia, both bound Hamilton County to the south. The City of Chattanooga lies entirely within Hamilton County and is the largest city in this region.

The northwest boundary of Hamilton County is formed by Walden Ridge which is extremely steep and mountainous. The top of the ridge, however, is part of the relatively flat Cumberland Plateau. The streams flowing into the right bank or north side of the Tennessee River generally originate several miles from the edge of the plateau then drop nearly one thousand feet down the escarpment into the river valley. Several of the damage centers in this study were communities at the base of Walden Ridge. The streams at these locations were generally unstable and characterized by alluvial fines, gravels, cobbles, and boulders.

The topography of the stream basins entering on the left bank or south of the Tennessee River is much different than those entering from the north, or right bank. The paralleling valleys and ridges become more rolling southeast of Chattanooga in Walker and Catoosa Counties. The gradient of the streams is very mild and the floodplains are silty sands with much more stable streambanks. A variety of size streams were included in the study with stream widths ranging from 15 feet to 150 feet.

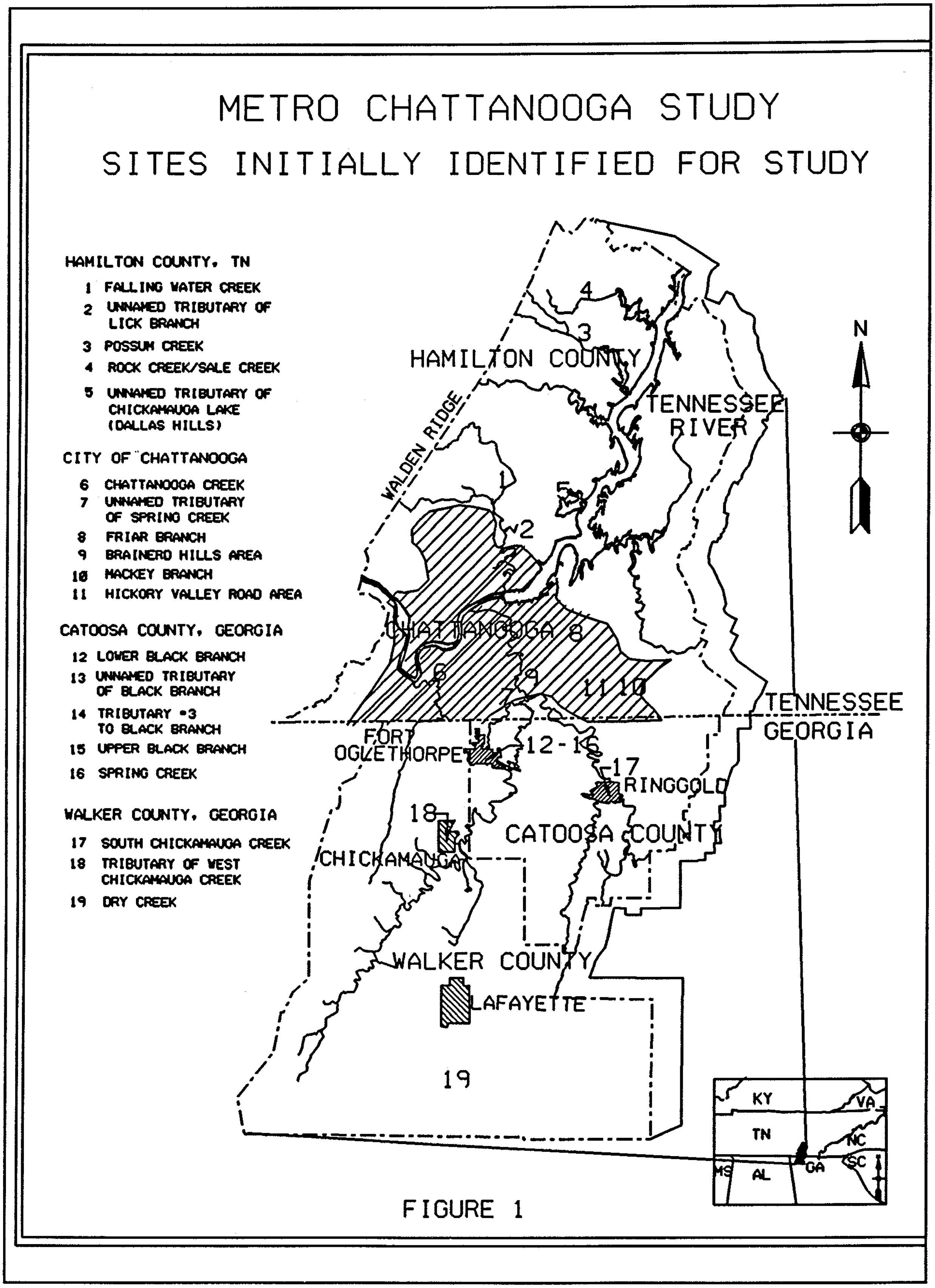

METRO CHATTANOOGA STUDY
SITES INITIALLY IDENTIFIED FOR STUDY
HAMILTON COUNTY, TN
1 FALLING WATER CREEK
2 UNNAMED TRIBUTARY OF LICK BRANCH
3 POSSUM CREEK
4 ROCK CREEK/SALE CREEK
5 UNNAMED TRIBUTARY OF CHICKAMAUGA LAKE (DALLAS HILLS)
CITY OF CHATTANOOGA
6 CHATTANOOGA CREEK
7 UNNAMED TRIBUTARY OF SPRING CREEK
8 FRIAR BRANCH
9 BRAINERD HILLS AREA
10 MACKEY BRANCH
11 HICKORY VALLEY ROAD AREA
CATOOSA COUNTY, GEORGIA
12 LOWER BLACK BRANCH
13 UNNAMED TRIBUTARY OF BLACK BRANCH
14 TRIBUTARY •3 TO BLACK BRANCH
15 UPPER BLACK BRANCH
16 SPRING CREEK
WALKER COUNTY, GEORGIA
17 SOUTH CHICKAMAUGA CREEK
18 TRIBUTARY OF WEST CHICKAMAUGA CREEK
19 DRY CREEK
HAMILTON COUNTY
WALDEN RIDGE
TENNESSEE RIVER
CHATTANOOGA
TENNESSEE
GEORGIA
FORT OGLETHORPE
RINGGOLD
CATOOSA COUNTY
CHICKAMAUGA
WALKER COUNTY
LAFAYETTE
N
KY
VA
TN
NC
MS
AL
GA
SC

FIGURE 1

COMMENCING THE RECONNAISSANCE STUDY

Meeting with local officials is an important event early in the reconnaissance study. This meeting should serve as an information exchange for both the Corps and the locals. The Corps team may explain study procedure to the local entities and discuss other available programs such as Planning Assistance to States (PAS), Floodplain Management Assistance, and Emergency Streambank Protection. The Corps is providing a service to the community. The local citizens' and officials' perceptions of both the causes of flood damage and the potential solutions are valuable information gathered at the beginning of the study.

An important item to discuss with local officials is the type of flood damage abatement alternatives they and their constituents expect to be evaluated. These alternatives should be addressed, if only at a cursory level. A significant consideration of any alternative carried forward for detailed analysis is the ability or the willingness of the locals to support the alternative.

It is important to remember that a study is as much a political process as an engineering process. We must provide local governments and citizens sound information. Even if the study does not produce a favorable recommendation, considerable information can be provided which may benefit the local people. Examples of such useful information would be first floor elevations which may be used by the locals for the FEMA flood insurance program, HEC-1 models which can be used to evaluate development impacts and detention impacts, HEC-2 models which can be used to update their FIS data or assist in a bridge replacement program, and updated frequency data which could be used in conjunction with any of the above.

The initial site visit is one of the most important steps in the study process and is the first opportunity to collect information. It is critical that experienced personnel (hydraulics, economics, etc.) be present to make decisions and initiate the evaluation process. Resources may be wasted if initial alternatives are incorrectly identified. The following list describes items evaluated during the initial site visit for the Metro Chattanooga study.

a. Damage areas for each of the nineteen sites were identified with the help of the local sponsors. A "feeling" for the magnitude of the flooding problem was determined. The approximate number of structures, depth of flooding, type of structures, and probable structure values were estimated.

b. The source of the flooding was surmised. In several cases both headwater and backwater flooding occur. This situation was noted for further research.

c. General characteristics of the streams were observed. Each stream's width, bank height, bank stability, evidence of sedimentation, and proximity to structures were noted.

d. Initial study limits for each stream were determined. All team members assisted in establishing this important parameter.

e. The probable pros and cons of various potential flood damage abatement alternatives were discussed among team members and the local representatives.

f. The constructability of various structural plans was considered. Alternatives which could not be constructed for physical and economic reasons, based on sound experienced judgement of the team members, were documented for future reference.

(Lesson #1) Only one team member was present during the initial visit. The other members on the initial visit were supervisors. While their notes and input was helpful early in the study, the remainder of the study team members required additional field visits to confirm earlier data and to become familiar with the project areas. These additional visits require valuable time and money.

DATA COLLECTION

Following the initial site visit, the next task was data collection. Required data could be categorized as existing data and new data. Existing data included past studies for the flood insurance program, topographic maps, and hydrologic data developed by the Tennessee Valley Authority (TVA). A sample of new data are first floor and ground elevations for structures in the floodplain, types of structures, and estimated real estate structure values.

Most of the existing data was obtained from TVA. The Corps of Engineers and the Tennessee Valley Authority share water resource development responsibilities within the Tennessee River Valley. TVA data included existing condition hydraulic and hydrology information for most of the sites in the study. The hydraulic data consisted of HEC-2 models. The hydrologic data was Bulletin 17C-type analysis at gage locations and regression discharges on non-gaged streams. The regression equations were developed by TVA and supersede USGS analysis for that region. TVA also developed an adjustment equation to account for urbanization effects. The TVA regression equations were used for streams which required development of an HEC-2 model. Availability of these models and regression equations proved a significant factor in meeting the reconnaissance study time frame with limited resources.

Existing mapping ranged from 20-foot contour USGS Quadrangle maps to detailed 2-foot contour CADD mapping. Many sources were used in search of mapping. The City of Chattanooga and the Metropolitan Chattanooga Airport Authority were able to provide the most detailed mapping. The quality of mapping played an important role in the appropriate outcome of this study.

Most new data was obtained by contract. Using FIS data, the 500-year floodplain limits were delineated on existing topographic maps. Contract surveyors obtained the first floor elevation, low ground elevation, and general information regarding each structure (type, foundation type, construction material, first floor area, number of chimneys, and address). The contractor was also required to furnish a photograph of each structure. Additional bridge and valley cross sections were also surveyed where needed.

CONTRACT FOR NEW DATA. With the twelve-month study limit, it was necessary to quickly let a contract to gather structure and hydraulic data for the fifteen remaining study sites. The total number of structures to be surveyed was estimated at 800 to 1,000. When the contract was complete, however, some 3,000 structures were surveyed three times the original estimate. This miscalculation was the direct result of using 20 to 30 year old maps. The contract cost increased accordingly. Another problem in gathering this new data was a poor scope of work. Specific instructions were not provided the contractor, inducing time-consuming debugging of the data.

(Lesson #2) When dealing with old mapping in growing metropolitan areas, be sure to conduct preliminary windshield surveys to determine the adequacy of your mapping. A more accurate number of structures to survey could have been determined with just a few days of field work.

The contract for structure data ran well behind the original allotted time of eight weeks. The contractor experienced further delay due to missing benchmarks in several of the rural sites. When the structure data was eventually received, additional time was not taken then for in-depth debugging or verification of the accuracy of the data. A quick estimate of damages was considered urgent to the reconnaissance "weeding" process.

SCREENING OF DATA

INITIAL STUDY AREA SCREENING PROCESS. Before the major data collection process was begun, we screened the nineteen potential study areas. Based on information gathered during the initial site visits and on cursory research conducted in the office, several areas were concluded to have no potential for Federal interest. Three of the sites were determined to be local drainage problems and one did not meet minimum drainage area criteria for Corps study. Therefore, fifteen areas remained for more detailed analysis.

SECONDARY STUDY AREA SCREENING PROCESS. Existing average annual damages (AAD) were considered necessary to further screen the fifteen remaining sites. All Corps districts use an economic model to calculate AADs. The Nashville District model is called the Direct Inundation Reduction Benefit (DIRB) model. It was adopted from a St. Louis District mainframe version years ago. The St. Louis version has been drastically modified by the Nashville District over the years to meet specific needs. Major inputs are structure data, HEC-2 profiles and depth-damage relationships. Nashville's DIRB model calculates physical damages to structures and their contents and to automobiles. The required structure input data is type, first floor elevation, the river mile location which floods the structure and current real estate structure values. The lowest ground elevation next to the structure is also input. The ground elevation data is not used by DIRB, but by a Nashville District nonstructural model called NSCOST which uses the DIRB input file.

Existing data provided most of the hydraulic profiles. Depth-damage relationships for each commercial and residential unit were taken from the 1970 Flood Insurance Administration (FIA) curves with modifications and are currently used for all Nashville district studies. Most of the structure data was received in the survey contract: first floor elevation, lowest ground elevation, type of construction, type of structure, and use. The only missing data needed to run the DIRB model was structure river mile and structure value. Using the best topographic maps available and Flood Insurance maps; river miles were quickly assigned to each structure. A shortcut was employed to establish structure values in this secondary screening analysis.

<u>"HIGH-END" AVERAGE SCREENING TOOL.</u> In the Nashville District, it is common practice at the reconnaissance level to obtain current real estate market values, as opposed to assessed values (for local taxes) for each structure in the structure file. It is the District's experience that assessed values for tax purposes are generally lower than current market values. In the Chattanooga study, lack of time and funds prohibited individual real estate appraisals of the 3,000 structures. A screening method was adopted which was called "high-end" average. This method was endorsed by the hydraulics, economics, real estate and planning study team members. Real estate appraisers established an average "high-end" value to the residential structures and another "high-end" average value to commercial structures in each area. An average "high-end" value was also given to mobile homes. This method had not been used in previous district studies, however the large scope of the Chattanooga effort forced time-saving techniques. The DIRB program was then used to calculate a screening level AAD for each area. The purpose of this tool was to identify areas with extremely low damages.

This secondary screening was not as effective as anticipated. Only two of the remaining fifteen sites resulted in damages low enough to dismiss on the basis of no potential for Federal involvement. The method did, however, signal data problems in several areas because the AAD amount appeared inordinately overstated. This lead to a time-consuming debugging process which included correcting structure codes (type), structure river miles, and first floor elevations.

(Lesson #3) Even though the "high end" screening of areas did not prove as successful as anticipated, this was a valuable time-saving step. The quick identification of data problems justified the effort. This approach will be used again in other studies of this magnitude.

CORRECTING DATA

<u>Structure Codes.</u> Many mobile homes and detached garages had been assigned the same "high-end" value as the neighborhood homes. No specific code had been assigned to designate mobile homes or detached garages when the contract data was gathered. This is typically not needed since an appropriate real estate value would have been assigned to each individual structure. Using the "high-end" method, however, required checking of each structure's photograph and reassigning proper real estate values to the mobile homes and detached garages.

(Lesson #4) Be sure to develop structure codes for all structure types which might be encountered in the structure survey. Detailed guidance for the contractor, complete with photographs of typical structures with their codes shown on the photograph, will eliminate most structure coding problems.

<u>Structure River Miles.</u> Another major source of error found in our data files was the assignment of river miles to structures. At the onset of this study, river miles were assigned quickly based on USGS Quadrangle maps. It was assumed that estimating to the tenth of a mile was sufficient. Often a subdivision or street of homes were assigned one river mile.

This method was used to expedite the coding of 3,000 structures. It was assumed adequate for the screening of alternatives. Once the results of the DIRB output files were interpreted, large pockets of excessive AADs were identified. Using the plot program HECSTR (developed by the Nashville District), it was concluded that large errors in the total AAD figures were resulting from either miscoded or too generalized river miles. As shown in the example HECSTR plot on Figure 3, a drop of 3 to 4 feet in water surface can occur within a one tenth of a mile reach. This is especially true at bridges. With the differences between a 2-year and a 500-year frequency flood falling within this range of error, the total AAD can vary from 0 to $30,000 per structure. For a typical damage reach with several hundred structures, millions of dollars in AADs can be easily added incorrectly. For relatively flat streams or backwater controlled reaches assignment of river miles proved reasonable, however, the majority of streams in this study were redone with newly estimated river miles to the one-hundredth of a mile. This effort significantly changed the total AADs for many of our damage reaches.

(Lesson #5) Care must be taken when assigning river miles to structures, particularly along steep streams. The river mile must accurately represent that portion of the stream profile which will flood particular structure. River miles estimated to the hundredth of a mile are reasonable for most streams.

<u>First Floor Elevations.</u> As mentioned earlier, a poor scope of work for the survey contract caused problems at several sites. Again, the DIRB output data lead to the source of the error. An unusually high percentage of total damage occurred below the first floor elevations. This information is one of the valuable outputs from DIRB developed by the District. It was found that homes with a split-foyer type design were the cause of the problem. The entrance of this popular 1970's home is located halfway between the upper and the lower floors of living space. The contractor logically established the lower floor as the first floor. For this structure type, however, the depth-damage relationship references the first floor as the upper level. Figure 2 shows the depth-damage relationship and the profile of a typical split-foyer home. Proper adjustments were then made to the first floor elevations.

(Lesson #6) This lesson is related to Lesson 4. Develop structure codes for all structures encountered in the structure survey. Detailed guidance for the contractor, complete with photographs of typical structures with their codes shown on the photograph, will eliminate most structure coding problems. Also, include clear instructions on where the first floor elevation should be taken.

<u>Miscellaneous Data Errors.</u> Typical errors were found scattered throughout the data in structure numbering, first floor elevations, and structure coding. Considering the magnitude of the data, 3,000 structures and over ten data items per structure, errors were inevitable. The contract data was provided in typical survey field books. District personnel input the information from the books into a database for each area. It is suggested that in future contracts, data be provided on computer disks to save time and minimize the opportunity for errors.

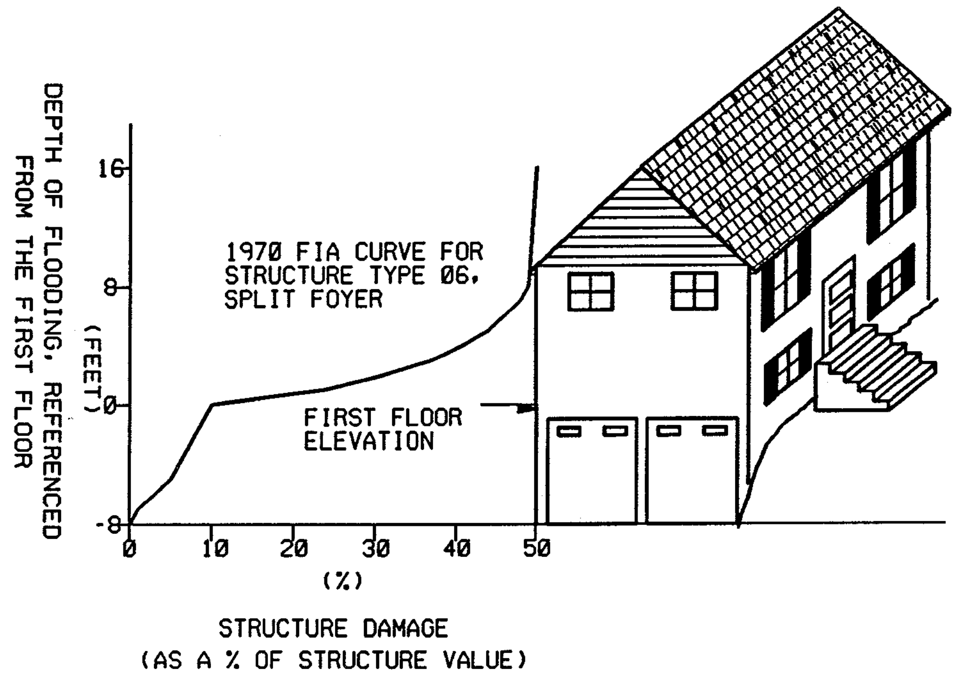


Figure 2

FURTHER ECONOMIC REFINEMENT

With corrected base data, the AADs were recalculated. To get a feel for the potential of the thirteen remaining sites to support a project, we used a rule-of-thumb that the maximum justifiable project cost is equal to ten times the AAD. This iteration provided much more reasonable damage estimates, however, the project costs were not believed sufficiently high to warrant elimination from further study. Therefore, all thirteen sites were considered further.

For the next stage of screening, better real estate values for each structure were required. To save time, real estate appraisers did not estimate current market values of all structures, but only those with annual damages over $2,000. Based on recent nonstructural projects in the Nashville District, the minimum cost of raising a home is approximately

$20,000. Using the rule-of-thumb, the AAD of a structure would need to be about $2,000 to justify the plan. This threshold, therefore, was determined to be the least damage which would support a nonstructural solution. The structures with damages over $2,000 were believed to be mainly responsible for justifying structural solutions. District real estate appraisers established current market values with the help of recent sales information. For the structures with AADs less than $2,000 resulting from the "high end" real estate values, the real estate values for these structures were adjusted based on a comparison with the appraised values. This correction was necessary to keep from overstating AADs.

SCREENING OF ALTERNATIVES

INITIAL SCREENING OF ALTERNATIVES. Since the remaining reconnaissance study time was limited, all opportunities were taken to conduct concurrent activities. An initial alternative screening was done, for example, while the real estate values were being obtained. Many alternatives could be eliminated based on current available data. Each of the thirteen areas were reviewed to determine the most likely alternative. The H&H Branch team members took the lead role in evaluating alternatives at this stage of study. For various reasons, detention structures (dams) were eliminated for all areas. For those areas in the northern portion of Hamilton County, insufficient controllable drainage area exists in the upper basins to provide adequate flood control. A detention structure downstream of the Cumberland Escarpment would require an extremely high structure and would continually fill with sediment. The cost of detention structures would far exceed the maximum benefits available. For several sites, the drainage basin above the damage area is too highly developed leaving no available area to place a detention structure and its required ponding area. The cost and impact on existing development would be too great. The remaining areas were flooded by very large streams. Detention solutions would require controlling a significant portion of the drainage basins and were clearly not justifiable.

To facilitate the screening of potential levee and channel modification alternatives, the computer program HECSTR was used to plot flood frequency profiles versus first floor elevations. This FORTRAN program was developed in-house for various uses, including debugging first floor elevation errors and HEC-2 profile problems. A sample screen format is shown in Figure 3. This program used with available mapping helped determine the preliminary feasibility of constructing levees. By reviewing the plots and mapping, the engineering feasibility of constructing levees was evaluated. The plots were used to define the aerial extent and depth of flooding. This was helpful in defining possible levee limits. The mapping was used to determine if a levee or floodwall could physically be constructed without removing most of the structures being protected. The area contributing to interior drainage was also defined. This information, along with experienced engineering judgement was used to determine the likelihood of engineering and economic feasibility. In all but four areas, levees were rejected as a potential alternative. In most cases the construction of a levee was not physically feasible or the anticipated costs (usually from interior drainage) were excessive when compared to the preliminary AADs.

Channel modifications were also appraised as a potential alternative for most streams. In those areas where the flooding was caused by backwater from another much larger stream, channel modification was not considered practical. For areas where headwater flooding controlled, the plots from the HECSTR program were used to determine the level of flooding at which the damages were occurring. Usually, channel modifications (channel

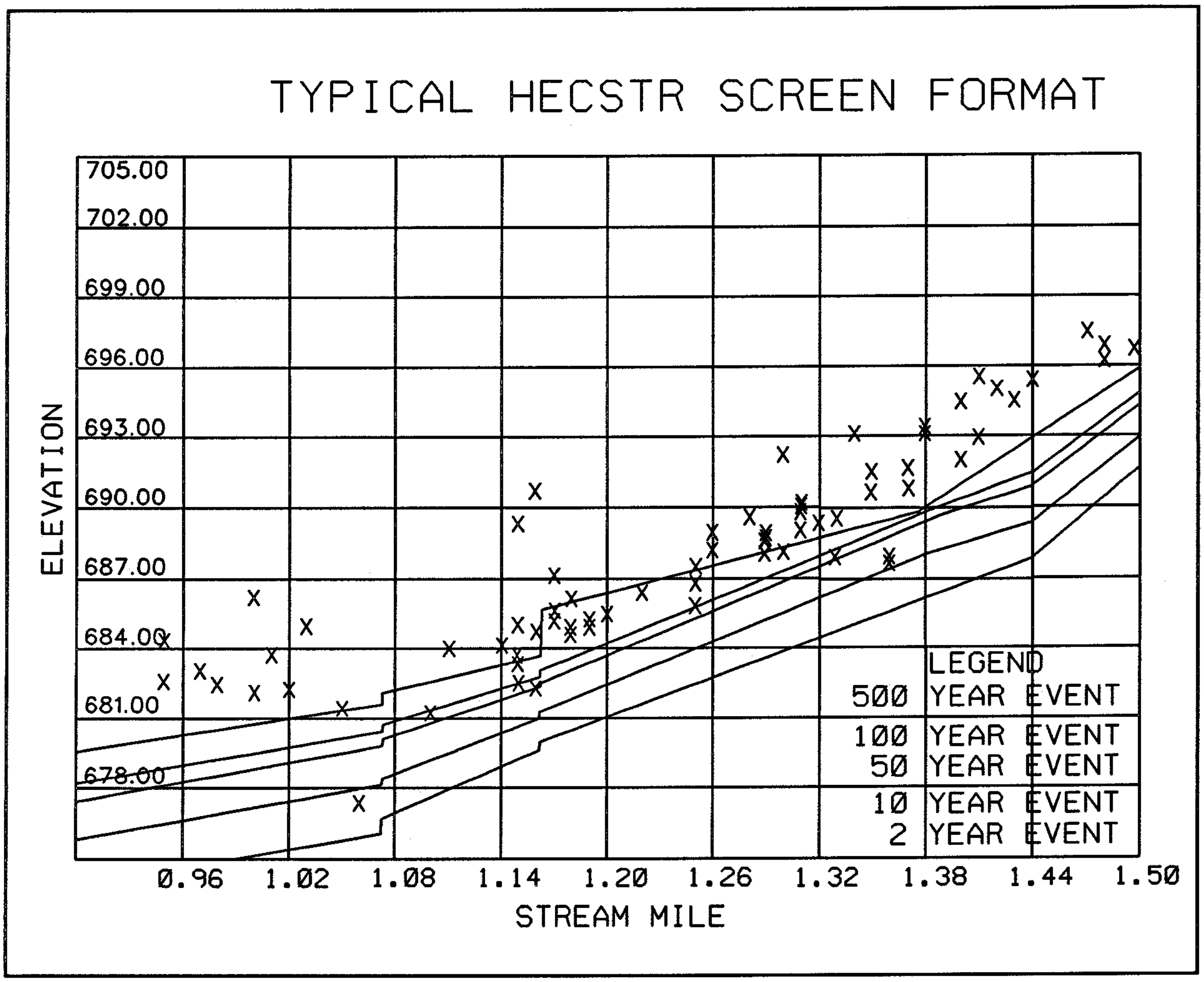


Figure 3

widening) have their greatest impacts on the more frequent floods. Especially in narrow floodplains with shallow depths of flooding. The plots also assisted in determining the limits of a potential channel modification scheme.

Another very useful tool in developing alternatives is to shade all structures with greater than $2,000 AADs on an aerial photograph. This will quickly highlight pockets of significant damages.

Using these approaches as well as screening potential alternatives based on the preliminary AADs and basic engineering judgement from experienced Hydraulic Engineers, Economists, Cost Estimators, and Planners, the most probable alternative was selected for each area. This selection process was conducted without detailed hydraulic, economic, or cost analysis. Time and money were conserved with this approach.

THIRD STUDY AREA SCREENING PROCESS. Once the average annual damages were revised based on accurate real estate values, a third study area screening was conducted. As a result of the new real estate values and other data corrections, the AADs were reduced significantly from those developed during earlier efforts. The rule-of-thumb was again applied to the current AADs to determine a maximum project construction cost which might be justified. Using the list of potential alternatives developed from the first alternative screening process, the thirteen areas were reviewed. Based on the same type of screening process described previously, detailed design and cost studies were recommended for nine of the 13 areas. Four sites were deemed to have insufficient AADs to justify construction of a flood damage abatement project.

At this point, in the study ten of the initial areas identified by the local representatives have been eliminated. This reduction in potential areas was accomplished through the screening processes just discussed without detailed alternative analysis (costs and benefits). This generated a notable savings in time and resources. During this process the local representatives were informed of our determination to eliminate the ten areas from further consideration.

ANALYSIS OF ALTERNATIVES

INITIAL DETAILED ANALYSIS. Of the nine areas remaining to be analyzed, levees/floodwalls was the preferred alternative of four. The other five areas had potential channel modification alternatives. The first step was to develop a preliminary design and cost estimate, then the potential for economic feasibility could be determined. For two of the levee/floodwall areas, only an approximate sizing of the pumping capacity was made. Based on pumping capacity versus cost curves developed by the Nashville District, the cost of these pumps was estimated. When the cost of the pumping plant alone was compared to the AADs, it was evident the projects were not economically feasible. Therefore, work was halted at these two sites. The other two levee/floodwall areas exhibited more potential and were expanded. Preliminary alignments were developed, top of levee determined, and pumping capacities along with ponding areas were computed. Based on average height, length, etc., quantities were developed for each alternative. The Cost Estimating Branch developed detailed estimates using unit costs from similar recent work.

Channel modification was the preferred alternative of the remaining five areas. The CHIMP routine in the HEC-2 model was used to determine the impact of channel widening. Three channel widths were analyzed for each area. The HEC-2 model was also used to make a preliminary estimate of the amount of material to be excavated. Reductions in flood heights for each channel width was determined. A comparison was made between the amount of flood reduction and the quantities of excavation to determine optimum channel width for economic justification. Actual excavation costs were not developed at this stage of screening.

Preliminary benefit/cost ratios were determined for each alternative. Only two areas suggested a potential positive benefit-cost ratio. One of the alternatives had a benefit/cost ratio greater than one, however, channel widening at the other site was too close to eliminate it from detailed analysis at this level of design and cost estimating.

FINAL DETAILED ANALYSIS. Final design of alternatives for four areas were initiated. Ironically, the four plans each had different potential sponsors. Two channel modification plans and two levee plans required refinement because each plan could lead to a cost-shared feasibility study. The final levee designs included details of the levee alignments, consideration of floodwall versus levee, and refinement of the pumping capacities and ponding areas. Quantities were being calculated based on actual levee alignments and ground elevations. Various alignments were considered to steer towards the most cost effective alignment. This effort was refined to minimize detail based on sound engineering judgement. District funds and time were limited, but the study team needed to scrutinize the plan's features if we were to recommend a plan with confidence. It was during this effort when hydraulic engineers experienced a "fortunate" misfortune.

The engineers were refining the pumping capacity and ponding areas. In order to avoid inducing any interior flood damages, ponding levels were kept below that which would have occurred under existing conditions. After careful review of existing mapping and the first floor elevations used in the DIRB program, an engineer determined an obvious bust in floor elevations of the survey data. A further review by the Survey Section and the contractor found a four foot error in the data. As a result of this finding, average annual damages dropped from $252,000 down to $55,000. Needless to say, if the error had gone undetected, the District could have recommended further feasibility study of a very uneconomic plan.

Refinement to the channel modification plans consisted of more accurate methods of determining quantities, evaluating rip rap requirements, and in one case determining the cost of necessary stable channel design methods due to a heavy sediment load. Two channel modification plans were recommended for further study.

(Lesson #7) Develop a method for checking survey data. One requirement which could have prevented the bust in elevation would be to prohibit loop surveying. Do not allow a line of levels to be tied into the same point from which they were started. If one benchmark elevation is entered into the field book incorrectly, then this mistake will show up when they try to tie into the next benchmark. If this method were used in this case, the bust of four feet would have been found and corrected before the data had been submitted.

SUMMARY AND CONCLUSIONS

The unusually large Metro Chattanooga Reconnaissance study forced the Nashville District Study team to employ all of the usual time-saving tricks and to invent a few new techniques. Most of the methods used were "business as usual"; however, others were attempted somewhat out of desperation. Likewise, some were successful and some only partially so. The methods used by the district to screen potential plans from the Hydraulic lead, as opposed to a Planning lead, are standard protocol. Time constraints forced methods such as the "high-end" structure values to determine potential average annual damages. This approach did not provide the anticipated screening results. The "high end" method, however, did prove beneficial in demonstrating data errors.

Many lessons were learned by the study team members. The District had never before conducted a reconnaissance study of such a magnitude. Limited resources required the use of shortcuts where possible. The most important lessons learned from this study concerned obtaining and reviewing needed field data. It is of utmost importance to provide the contractor as much guidance as possible. A typical sketch or photograph of every structure type likely to be encountered in the study area should be provided the contractor. The appropriate structure code and point where first floor elevations should be taken must be clearly labeled on these sketches or photographs.

Another lesson learned is field checking the available mapping. This is particularly important when using older mapping in rapidly developing areas, such as Metropolitan Chattanooga.

Developing a method to spot check surveyed elevations has become very important. Errors in contractor surveyed elevations have been found in other studies conducted by the Nashville District. In fact the errors were identified while designing a preliminary interior drainage plan for a prospective levee project, similar to the Chattanooga study. One possible preventive fix, which will be required in all new survey work of this nature conducted by contractors for the District, is the elimination of surveyed loops. Each line of levels will have to tie into a different benchmark from where the line started.

The final lesson learned and equally important as the survey data is determining the appropriate river mile to associate with each structure in the data base. Projects can be made or lost on how well the structures relate to the water surface profiles. Where streams have a steep slope, designation of the river mile to the hundredth of a mile is probably required. Other problems may result from cross section river miles (used to develop the profiles) not corresponding to the map river miles used to designate the structures. This problem usually occurs when profiles were developed by others. Mapping showing the location of each cross section is usually not available. The most experienced members of the study team need to accomplish this item.

The Metro Chattanooga study recommended further study of three sites. These three projects are recommended to be considered under Section 205 of the Continuing Authorities program. As concluded, an Initial Project Management Plan was not required to continue the cost-shared feasibility phase (Detailed Project Report) of these projects, however, the same confidence in the recommended plan was necessary regardless of the outcome. After all, even under the Continuing Authorities program, the feasibility stage of study is cost shared. The same approach necessary to develop an IPMP was taken to develop the feasibility cost estimates for the resulting three Section 205 projects. The main difference between the two was the amount of documentation required.

IMPORTANCE OF THE STUDY TEAM

by

Dr. Surya Bhamidipaty[1] and Mr. Jerry W. Webb[2]

INTRODUCTION

Effectively managing and influencing the diversity of personnel responsible for performing studies and preparing designs clearly is a key to a project manager's success. Because of their multi-disciplinary and interdependent nature, project teams demand highly attuned team building skills by which they can achieve project objectives. A project team is a collection of people who must rely on cooperative group effort and on the specific skills and abilities of each interdependent team member. Each team member's skills complement the efforts of the team and assure goal attainment. Through effective team work, a group can generate solutions to problems that are far superior to those developed individually by its team members. Managers must be able to examine team effort with a skilled eye and determine what restraints are blocking maximum productivity. Then, with the help of the team, the managers must devise a strategy to overcome or remove obstacles and combine team resources to achieve project goals.

CHARACTERISTICS OF A TEAM

General. The following are some of the essential elements that lead to successful team performance:

- Charter
- Mission
- Reason
- Sense of interdependence
- Commitment
- Accountability
- Communication

---

[1]Chief, Hydrology and Hydraulics Branch, Huntington District, U.S. Army Corps of Engineers.

[2]Chief, Hydrology Section, Huntington District, U.S. Army Corps of Engineers.

Effective Teams. The characteristics of an effective team are:

- Clear and well understood priorities

-Team objectives are clarified and discussed frequently

- Consistent and appropriate leadership

- Motivation

- Successful resolution of disagreements

- Quality of team interactions

- Attention to details

- Anticipation of problems

- Follow through on plans

- Continually strengthen the bond of friendship and respect

Ineffective Teams. Ineffective teams are characterized by:

- Wasted energy defending actions

- Competition with each other

- Tendency to demean or diminish team members

- Lack of collaboration toward achieving common goals

- Lack of support and encouragement of new ideas

- Emphasis on personality factors

- Energies are funneled into wasteful practices that lead to negative output

STAGES OF TEAM DEVELOPMENT

General. There are four stages in team development

1) Establishing Identity

   a) Allow ample opportunity for team members to get to know each other

   b) Affirm and legitimize the distinctive abilities and strengths of each participant

c) Clarify work expectations and rules that will govern team performance

d) Agree on the major mission and determine the objectives and priorities of the team

2) Questioning Authority

3) Productivity

4) Uniting

The Team Development Process. Team building is the process of creating and then maintaining effective team functionality. It takes time and commitment, but the results are significant in terms of higher morale and performance, increased productivity, and innovative problem-solving.

Team development is concerned not only with cost, schedule and technical performance parameters but also with human interactions and feelings that arise during the project effort. A major objective of team building is to assist teams in managing their task and interpersonal concerns.

Team development begins with the group's recognition that it is dealing with significant issues related to improving team effectiveness. Norms supporting candor, openness, and trust are reinforced early on through successful experiences in participative problem-solving and decision-making. Providing opportunities for the development of trust facilitates problem solving by increasing the exchange of relevant information and open discussion.

One fundamental ingredient of team development is full participation of each team number in accomplishing whatever objective the group sets out to achieve. The most effective means of implementing any plan, strategy or procedure is by encouraging the full participation of those who will be responsible for its final implementation. Participation translates into commitment and creates a psychological bond between the plan and those who generate it. This is the "buy in" that project managers, especially those working within the matrix project organization, strive to accomplish. If commitment is the desired outcome, then participation in the matrix sense must be encouraged.

Steps in the Formal Team Building Process. The formal team building process consists of activities carried out in the early stages of the project and then integrated into ongoing project activities. Because there is usually little time to set aside for special team building procedures, team building must often be incorporated into planning sessions, review meetings, and informal updates or discussions on project status. The objective of team building is to increase the team's productivity and performance. Objectives are accomplished by focussing on team mission, determining key tasks and responsibilities, and developing team roles. The following are the steps involved in a formal team building process:

1) Establishing a Positive Environment. This involves

   - o Helping participants to understand team building
   - o Generating commitment to the benefits of the process
   - o Defining goals of team building
   - o Determining how team building can contribute to project objectives
   - o Determining what it requires in terms of time and commitment

2) Developing a sense of Interdependence:

   - o All members must respect their team member's complementary talents
   - o Time must be provided to discuss members' backgrounds
   - o Team members must recognize how these diverse backgrounds contribute to the fulfillment of the team mission

3) Define and Clarify Team Goals:

   - o Team members must understand and accept project goals
   - o Expectations of what is to be accomplished must be developed by the team
   - o Objectives should be reviewed periodically
   - o Plans must be developed to deal with conflicts

4) Role Definitions:

   - o Each function's responsibility must be clearly determined
   - o Responsibilities must be defined in terms of accomplishing the project mission
   - o New roles, if necessary, are negotiated and developed

5) Developing Procedures:

   - o Guidelines and policies must be developed for recurring and special issues
   - o Who should attend review meetings

- o How cost data should be tracked
- o When status reviews should be conducted

6) Developing a Decision Making Process:

- o Determine responsibilities for decision making
- o Who should be directly involved
- o How they will be involved

THE ROLE OF THE PROJECT MANAGER

Creating a winning team involves a continual attempt at maintaining effective team relations and molding a group of strangers into a workable unit. It is one of the most exciting and difficult challenges a project manger will face. Some management strategies for developing this sense of team spirit include:

- o Providing accurate and continual feedback to the group about its performance
- o Including team members in the goal settings and decision making process
- o Keeping channels of communication open among team members, perhaps with regular meetings or informal discussions
- o Encouraging supportive communication
- o Developing mutual understanding of roles and responsibilities

SOURCES AND CONSEQUENCES OF CONFLICT

Sources. Conflicts arise among team members due to:

- o Divergent goals
- o Roles
- o Perceptual differences
- o Values
- o Scarce resources
- o Personality styles

Consequences. Conflicts could result in the following:

- o People may feel defeated
- o People may withdraw
- o Negative stereotyping may occur
- o Distorted perceptions are likely
- o Communication may decrease
- o Resistance to teamwork increases

BENEFITS OF TEAM WORK

The days of working in isolation are over. Working in teams is the only way to do our work. If we can embrace the spirit of team work, as they do in professional sports, it could bring the following benefits:

- o Access to greater amounts of knowledge and experience
- o Lateral thinking through interaction
- o Higher quality decisions-unworkable alternatives are more likely to be spotted
- o Increased efficiency and resolution of long standing problems
- o Break down of departmental and social barriers, leading to greater understanding of different functions
- o Skill and knowledge enhancements
- o Improved motivation and communication

PERSONAL EXPERIENCES

We would like to share our personal experiences with regards to study teams in private industry and the Corps of Engineers.

Private Industry. The concept of study teams works very efficiently in private industry. Possible reasons observed through our personal experiences for such success are as follows:

1. Project Manager (PM) is given full responsibility and authority for successful completion of the project within budget and on schedule without sacrifice in quality.

2. PM's are well qualified with broad experience who can detect barriers to progress and provide smooth paving for successful completion.

3. PM's salary increases and bonus are tied down to his performance.

4. PM closely follows the day to day progress, schedule periodic meetings with all team members and irons out any differences between team members.

5. There are no external reviews. All the reviews are done internally with an independent group of engineers.

6. Team members commit to the project and know their responsibilities.

7. PM provides input into the performance appraisal of the team members.

8. Information is processed and passed on to team members without any undue delays.

Chicago District DERP Study. The study team concept worked exceptionally well on this project because:

1. The Commander had taken it as a challenge and made it one of his top priority projects.

2. Required weekly briefings on the progress.

3. Team members had the commitment and provided full support.

4. Functional barriers were removed and easy access across the lines was provided.

5. All the support elements provided full and timely support.

Huntington District; Pond 16 Plans and Specifications. This project utilized a unique application of the study team concept with a high level of success. Main points of interest are as follows:

1. Participative Management at Branch Chiefs' level.

2. Accountability and responsibility were given to team members.

3. No higher level review within the Corps. Independent review was done by an AE.

4. Higher level management and PRB were not involved.

5. Required Extensive Coordination - State Dam Safety, DNR, Fish and Wildlife, MRD, USATHEMA.

6. Surveying was provided by AE and mapping was provided by the in-house staff.

7. Outside consultants for geotechnical and structural work.

8. Required contract negotiations.

9. Work was completed within budget and on schedule.

10. 100% support was provided by every team member.

11. Commendation was provided by MRD for a job well done.

Huntington District; Columbus OH Local Protection Project. This project represents a situation that shows how the study team process can break down. Eventually, the study team resolved problems and removed obstacles that restricted their productivity, but not before significant effort was expended. The following factors led to the problems encountered:

1. Initially, Project Manager responsibilities were placed in a technical service organization. When the scope of work changed to reformulation of the project instead of simply optimizing one particular design configuration, the management responsibilities were not shifted, as they should have been, over to plan formulation.

2. No specific guidance or direction came from the project life cycle arena.

3. Stove-pipes functioned but there was essentially no interaction between the various disciplines involved.

4. Design alternatives were evaluated without benefit of timely economic and cost data. Costs and benefits for alternatives were sometimes unknown to District study team members prior to technical meetings with the local sponsor/customer.

5. Top management and key team members had minimal commitment to the project. The perception that this study was only a technical design report that would essentially evaluate an already approved plan caused confusion in the required scope of work.

6. Total disruption of the study occurred when alternatives were mandated by Division offices. Chaos resulted when meetings with the local sponsor/customer were handled by ORD personnel without participation by civilian employees at the District level.

7. Initial project design was closely coordinated with HQ, but when problems occurred, HQ was not included in the resolution of problems.

8. Functional barriers between support organizations could not have been much worse. Protecting turf, pointing fingers, and documenting of mistakes/delays seemed to take priority over working together as a team to provide a quality product.

9. The real reason for failure of this team was the failure during the Re-evaluation Report to perform the interior analysis to the proper level. The final recommended plan that was included in that report was arbitrarily reduced in scope/size to meet cost limitations for the total project. Benefit, hydrologic, and hydraulic analyses were not performed to be sure that the revised configuration would meet the project goals. This study team was totally focused on refining a plan that had not been properly formulated and optimized.

SUMMARY

The importance of the study team concept to a project's success is more critical now than ever before in the long history of the Corps of Engineers. Budgetary restraints and cost sharing arrangements dictate that the Corps must do a better job of developing quality products with less expenditure of time and money. This paper attempts to address basic principles of building a successful, effective study team that emphasizes mission accomplishment. Ultimately, a study team will only function successfully if effective leadership is provided and all members participate to the fullest extent of their abilities.

MILWAUKEE METROPOLITAN AREA, WISCONSIN
FLOOD CONTROL STUDY

by

Robert Elkin[1]

INTRODUCTION

The Reconnaissance Report on the subject study was completed in February 1991 and concluded that a flood control project, consisting of a turf lined channel with detention/retention basin for the area extending from West Hampton Avenue to North 35th Street, is feasible. The report also concluded that a concrete lined channel was economically justified and should be considered further in the feasibility study. As a result of numerous coordination meetings with higher headquarters, several adjustments to the February 1991 Reconnaissance Report were made. These adjustments outlined the need to perform additional engineering studies in the feasibility phase including additional detention area investigations, construction material unit price adjustments, and additional soil borings at bridge locations. As a result of this additional work, the total first cost for the turf lined channel with detention basin increased to $16,542,000 and the cost of the concrete lined channel increased to $23,169,000.

The Reconnaissance Report including the Feasibility Cost Sharing Agreement (FCSA) and Initial Project Management Plan (IPMP), were coordinated with higher Corps of Engineers headquarters and the local sponsor pursuant to obtaining certification to execute the FCSA. Accordingly, certification from the HQUSACE was received on December 1991 and provided the basis for proceeding on with the feasibility study. Upon adjusting the feasibility study schedule, since certification had been anticipated in September 1991, and revising the IPMP to address comments received from this office, the Executive Director of the Milwaukee Metropolitan Sewerage District (MMSD) - the study sponsor - and the Detroit District Commander signed the FCSA.

The feasibility study will involve a more detailed investigation of flood control alternative plans, both Federal and non-Federal. The Federal alternatives which will be investigated further include the concrete lined channel and turf lined channel (trapezoidal) with detention/retention basin alternatives. Additional flood control alternatives that will be considered by the local sponsor include: 1) incorporation of additional off-line and on-line retention/detention basins in conjunction with the soft channel lining materials; and 2) terracing of the channel with incorporation of channel meanders, low flow fish channels, pools, riffles, fish refuges, and other features designed to retain or enhance aquatic populations. The local sponsor will be independently evaluating effects of removing existing concrete channel lining materials from various locations along Lincoln Creek on flood control. In addition, the effects of Estabrook Dam removal, located on the Milwaukee River downstream of the project area, on flows and sedimentation are also to be evaluated. The

[1]Physical Scientist, Detroit District, U.S. Army Corps of Engineers

non-Federal project alternatives that are being considered in the interest of enhancing the environment are in the primary areas of water quality, wetland preservation, and safety and crime prevention. Only those items which directly relate to the flood control study were considered for in-kind service credit in the feasibility study.

The feasibility study was initiated on 23 March 1992 upon receipt of matching shares of study funds in the amount of $182,000 from the study sponsor and the HQUSACE to accomplish Fiscal Year 1992 work activities. The feasibility report is scheduled to be completed by 31 March 1995, which is 36 months following initiation of the study. The feasibility phase, which would include coordination and review of the feasibility report with higher Corps headquarters, is scheduled for completion by 30 September 1995, which is 42 months following initiation of the study.

STUDY BACKGROUND

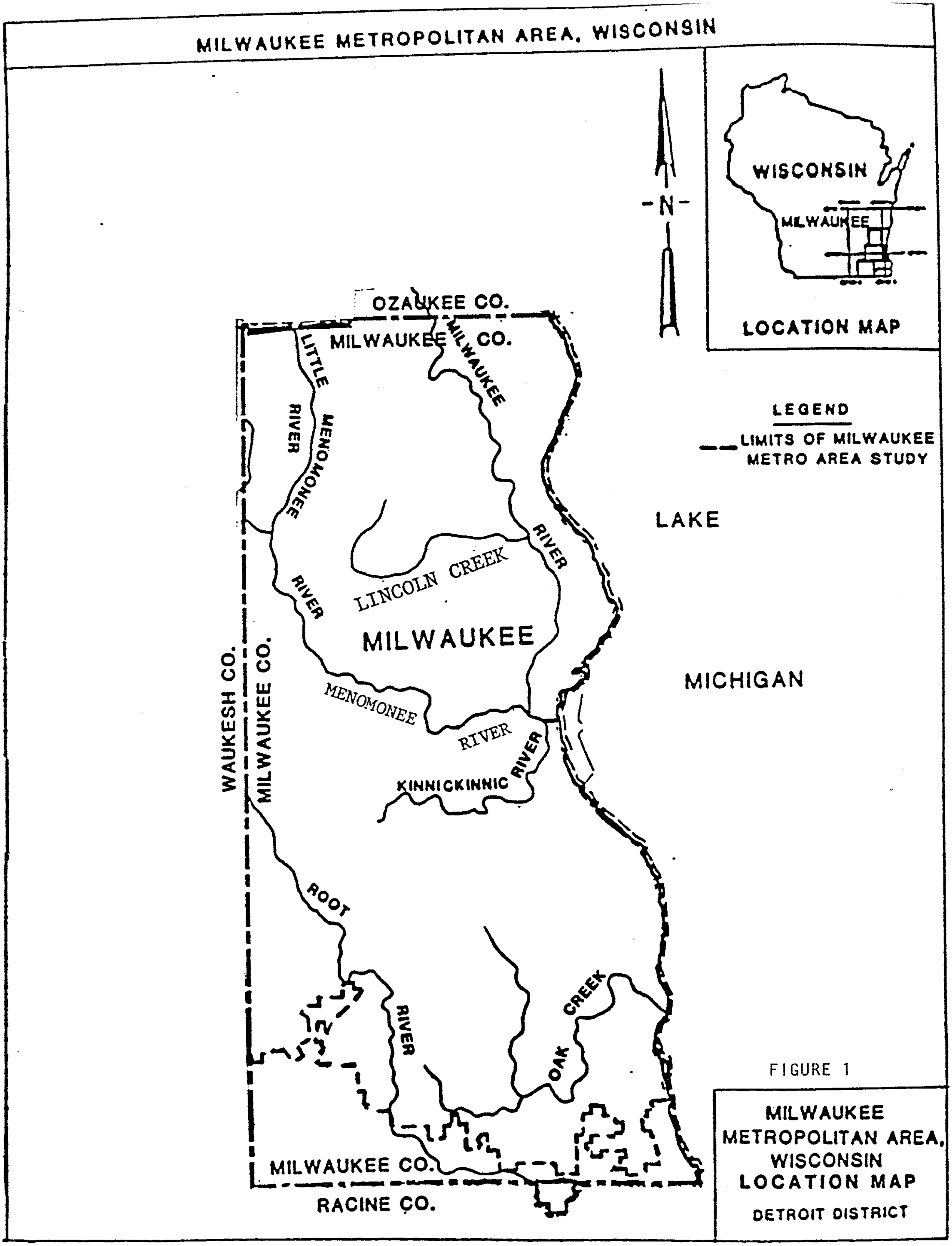
Study Authority. The reconnaissance study on flood control improvements in the Milwaukee Metropolitan Area, Milwaukee, Wisconsin, was authorized by a resolution of the Committee on Public Works and Transportation of the U.S. House of Representatives, adopted 8 September 1988.

Location of Study Area. The Milwaukee Metropolitan Area is located in Southeastern Wisconsin along Lake Michigan (see Figure 1). In 1986 and 1987, severe flood problems occurred throughout the five major watersheds located in the area: The Milwaukee River, Menominee River, Kinnickinnic River, Oak Creek, and Root River. The 1986 event included a fatality and total flood damages of $6 million.

Study Sponsor. By letter dated May 10, 1988, the Milwaukee Metropolitan Sewerage District (MMSD) stated its support of a flood control study in the Milwaukee Metropolitan Area.

Flood Control Studies. Prior to initiation of activities under the 1988 Resolution, reconnaissance flood control studies were undertaken for the Root River, Menominee River, Oak Creek and Lincoln Creek, a tributary of the Milwaukee River, under the Corps of Engineers Section 205 Continuing Authorities Program. These studies concluded that Section 205 flood control measures could not be economically justified for the Root River, Menominee River, and Oak Creek. However, on a more positive note, flood improvements for a 2.0 mile reach of Lincoln Creek were found to be economically justified. In this area, approximately 1,600 homes were found to be subject to 100-year flood level damages. The flood control measures found to be economically justified included a concrete lined channel and a turf lined channel.

Change of Study Authority. Due to Federal project cost limitations on Section 205 flood control studies, the MMSD testified before Congress for the need to investigate the flood problems in the Milwaukee Metropolitan Area under a Congressionally authorized study. Accordingly, Congress passed a resolution which authorized a general investigation study that directed the Corps of Engineers to review flood control measures for streams located in the vicinity of the Milwaukee Metropolitan Area.


MILWAUKEE METROPOLITAN AREA, WISCONSIN
WISCONSIN
MILWAUKEE
LOCATION MAP
N
LEGEND
LIMITS OF MILWAUKEE METRO AREA STUDY
OZAUKEE CO.
MILWAUKEE CO.
LITTLE MENOMONEE RIVER
MILWAUKEE RIVER
LINCOLN CREEK
MILWAUKEE
MENOMONEE RIVER
KINNICKINNIC RIVER
ROOT RIVER
OAK CREEK
WAUKESH CO.
MILWAUKEE CO.
LAKE MICHIGAN
MILWAUKEE CO.
RACINE CO.
FIGURE 1
MILWAUKEE METROPOLITAN AREA, WISCONSIN LOCATION MAP
DETROIT DISTRICT

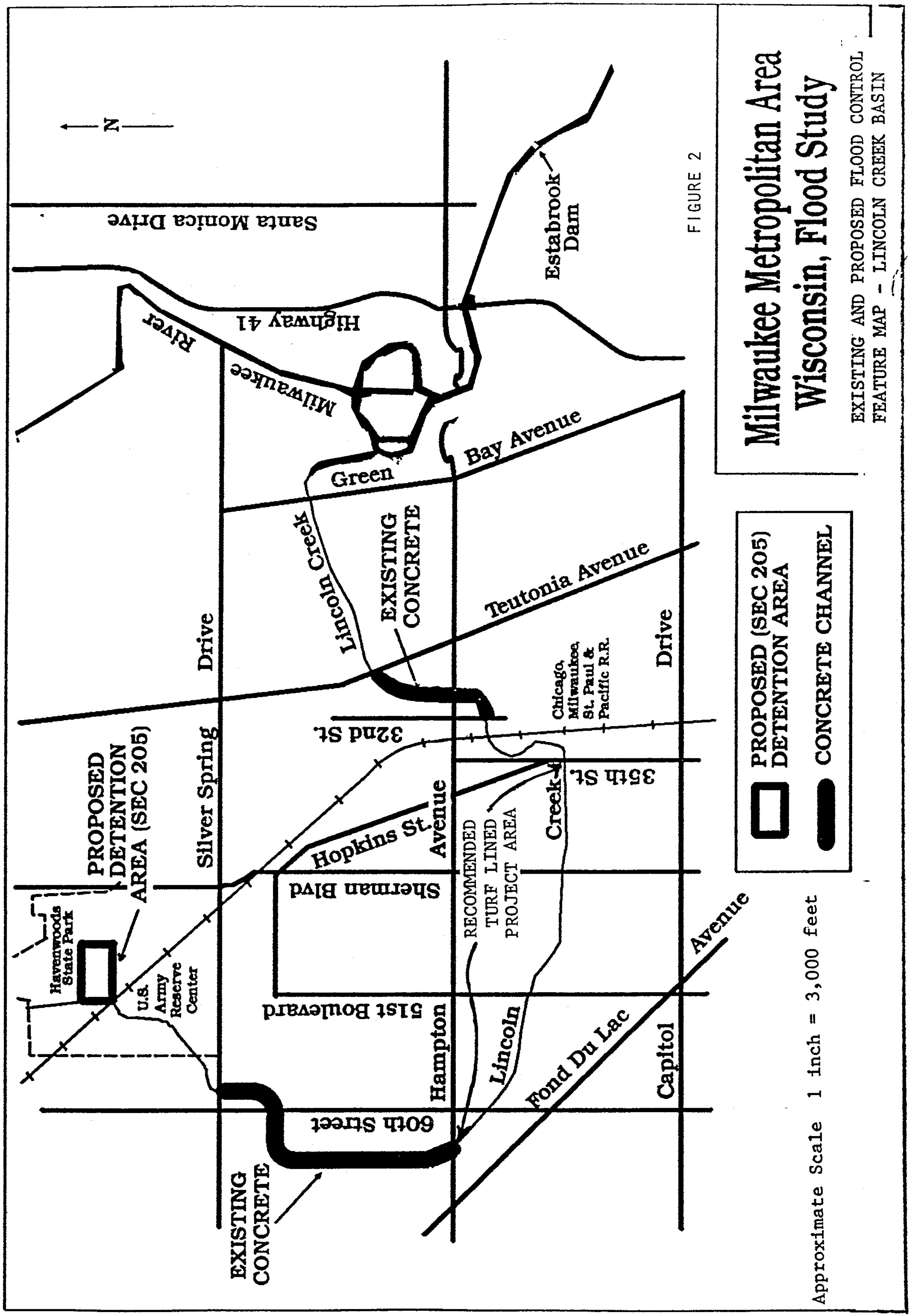
Accordingly, a general investigation reconnaissance study was initiated in 1990 to further investigate flood problems in the Milwaukee Metropolitan Area (MMA). The reconnaissance report was completed in February 1991. A review of flood problems in the MMA was accomplished under the general investigations authority. This study reaffirmed the findings of the previously completed Section 205 studies, that Corps of Engineers participation in a flood control project was not economically justified for watersheds investigated, except for the Lincoln Creek sub-watershed. Other areas throughout the metropolitan area did not have sufficient flood problems or apparent flood control benefits to support further detailed investigations.

Potential Federal Projects. As indicated previously, Section 205 reconnaissance studies for the Menomonee River, Root River, and the Kinnickinnic River watersheds were previously completed. These studies concluded that flood control projects were either not economically justified (Menomonee and Root Rivers). In regard to the Kinnickinnic River Watershed, local interests have implemented flood protection measures along the majority of its flood prone areas. These measures were designed to provide 100-year flood protection to flood prone areas; thus, most of the flood damages that occurred in this watershed were eliminated for this level of protection.

Lincoln Creek Watershed. The Lincoln Creek Watershed extends from its headwater area near N. 76th Street and West Good Hope Road approximately 9.7 miles to its confluence with the Milwaukee River (see Figure 2). The section of channel extending immediately upstream of West 35th Street and extending downstream to beyond Teutonia Avenue is deeply incised. The maximum depth in this area is estimated to be 50 feet. From this point to its mouth at the Milwaukee River, the channel is bordered by a relatively wide floodplain which has been developed into a parkway. The channel extending from West 35th Street to North Hampton Avenue, which extends for approximately two miles and is the primary Corps of Engineers study area, is primarily a natural channel although some channel deepening has occurred and intermittent concrete lining has been placed to withstand high flow velocities. The area located along this two mile reach is highly urbanized and approximately 1,600 structures, which consist primarily of private residences, are subject to flood damage. Two areas of the Lincoln Creek channel have existing concrete lining. These areas extend downstream of 35th Street to a few hundred feet downstream from Teutonia Avenue and from North Hampton Avenue north to West Silver Springs Road. North of West Silver Springs Road to North 76th Street, the channel narrows considerably and flows in this area are relatively low.

Lincoln Creek Flood Damages. Flood records for Lincoln Creek are only available since 1960. For the period extending from 1960 through 1986, a variety of flooding and water related problems have been reported by property owners in the area, which included first floor flooding, yard flooding and basement flooding.

The greatest floods occurred in 1964, 1965, 1968, 1973, and 1986. During 1986, there were six storm events for which flooding in the Lincoln Creek watersheds was documented. The most common complaint was basement flooding resulting from localized ponding. Approximately 1,600 homes are subject to flooding in the Lincoln Creek Watershed. Flooding of roadways and underpasses has also occurred frequently.


Milwaukee Metropolitan Area
Wisconsin, Flood Study
EXISTING AND PROPOSED FLOOD CONTROL
FEATURE MAP - LINCOLN CREEK BASIN
FIGURE 2
PROPOSED (SEC 205) DETENTION AREA
CONCRETE CHANNEL
Approximate Scale 1 inch = 3,000 feet
N
Santa Monica Drive
Estabrook Dam
Highway 41
Milwaukee River
Green Bay Avenue
Lincoln Creek
EXISTING CONCRETE
Teutonia Avenue
Silver Spring Drive
Chicago, Milwaukee, St. Paul & Pacific R.R.
Drive
32nd St.
35th St.
Creek
RECOMMENDED TURF LINED PROJECT AREA
Hopkins St.
Hampton Avenue
Sherman Blvd
PROPOSED DETENTION AREA (SEC 205)
Havenwoods State Park
U.S. Army Reserve Center
51st Boulevard
Lincoln
Fond Du Lac Avenue
Capitol
60th Street
EXISTING CONCRETE

The section of Lincoln Creek that received major flood damages, which includes 1,600 homes which were subject to major flood damages, extends from North 35th Street to West Hampton Avenue. Alternatives that had favorable benefit-to-cost ratios in the reconnaissance report that are to be considered further in the feasibility report include the concrete lined channel and turf lined channel with retention basin.

The first cost of the turf lined channel with retention basin was estimated to be $16,542,300 while the first cost of the concrete lined channel was estimated to be $23,168,700. The average annual benefits and average annual cost of the turf lined channel with retention basin alternative were determined to be $2,295,000 and $1,621,700, respectively, resulting in a benefit- to-cost ratio of 1.4. The average annual benefits and average annual cost of the concrete lined channel alternative were determined to be $2,510,200 and $2,309,200, respectively, resulting in a benefit-to-cost ratio of 1.1.

Although the turf lined channel had a higher benefit-to-cost ratio (1.4) than the concrete lined channel (1.1), the concrete lined channel was the recommended plan as it was concluded that this plan would definitely withstand the flow velocities in Lincoln Creek. However, social and environmental factors resulted in a recommendation that both alternatives be carried into the feasibility study phase.

Technical Review Conference. Following submittal of the Reconnaissance Report in February 1991, a Technical Review Conference (TRC) was held to reach agreement on the engineering aspects of the Feasibility Cost Sharing Agreement (FCSA) and to determine the need for additional TRC's during the feasibility phase as well as the need to prepare design memorandum (DM's) during PED. Specific items discussed during the TRC and the Reconnaissance Review Conference (RRC), which was held the following day and included representatives of the study sponsor and other local interests, are presented as follows:

1) Need for Design Memorandum. Detroit District representative stated that going directly from the feasibility phase to the plans and specifications stage could not be accomplished and that a DM is necessary due to the level of technical data and detail that would be required. Representatives from CENCD agreed with this position. HQUSACE representatives suggested that the project could be broken into various segments and that some segments could be taken to DM quality in the feasibility phase while DM's on other segments were being completed. HQUSACE representatives further stated that the direction to follow would be a Division/District decision but stressed that if any DM type efforts were to be done in the feasibility phase, the IPMP would need revision. It is anticipated that certain feature DM's will be prepared following the feasibility study to appropriately address complex aspects associated with the flood control study.

2) Turf Lined Channel Versus Concrete Lined Channel. HQUSACE representatives expressed concern that a completely turf lined channel could not withstand channel flow velocities in excess of 5 feet per second. Further concern was expressed that channel widening may be required with a turf lined channel.

The potential to develop a viable terraced channel, or earth trapezoidal channel, may be limited by existing Right-of Way. It may be subsequently found in the feasibility phase that it may not be practical in many reaches since adjacent open land is limited. The Detroit District representative reflected that the turf lined channel is the one supported by the local sponsor and local interests in general, and that there is no local support of a concrete lined channel. Further discussion on this issue led to the decision that the local sponsor should be informed that the concrete lined channel be the recommended plan in the <u>reconnaissance</u> phase since it is an alternative that would effectively eliminate or substantially reduce flood damage in the study area. However, it was emphasized to local representatives, due to the strong local support, that the turf lined channel would certainly be given further consideration in the feasibility phase and could result in being the locally preferred plan.

3) <u>Retention Basin</u>. HQUSACE representatives questioned whether or not the retention basin was part of the proposed flood control project or only preferred by the local sponsor to facilitate removal of the downstream area concrete. Detroit District representatives responded that the retention basin would reduce downstream stage levels with or without the concrete removed. It was concluded that it is a necessary part of the project and recognized that retention basins, as well as all other project features, would have to be incrementally justified during the feasibility phase.

4) <u>Borings</u>. North Central Division representatives questioned the number of borings proposed in the IPMP. It was stressed that the number of borings may not be adequate to provide the data necessary to accomplish detailed engineering work. The number of borings were reviewed by Detroit District representatives and additional borings were added during the feasibility phase.

5) <u>Additional Survey Data</u>. Detroit District representatives stated that the IPMP should be revised to include additional survey data in the feasibility phase. This information would consist primarily of additional aerial mapping which would be used as a base on the CADD system.

6) <u>Excavation of Channel Material</u>. HQUSACE representatives stated that the quantity and make-up of materials to be excavated should be verified and that any HTW type material encountered would have to be removed and disposed of at the local sponsor's expense. This cost would be considered a project cost and the local sponsor would be given no credit for these costs.

7) <u>Channel Deepening</u>. During the process of channel deepening, sedimentation and channel stability could be a problem. Therefore, it was recommended that a two phase analysis be conducted to investigate potential channel deepening problems. Accordingly, the Detroit District added this approach to the IPMP. The activity would be performed by Waterways Experiment Station personnel.

8) Removal of Existing Concrete. Detroit District personnel advised that the local sponsor is interested in removing concrete which is presently located upstream and downstream of the primary project area. It was further emphasized that removal of concrete in the upstream area may create a stability problem for home owners on both sides of the creek due to a lack of right-of-way required to increase the cross section area of the channel. Technical staff at the TRC expressed serious reservations on its removal from an engineering standpoint and stated that any such action would not be funded or supported by the Corps. They further directed that the base condition for the study would include the existing channel features such as concrete lining.

9) Flood Warning System. It was emphasized that a flood control project should include development of a flood warning system, which must address flood preparedness aspects.

10) Need for Additional TRC. Some reaches of the Lincoln Creek channel are deeply incised and the channel cross section area is restricted by historical bridges. Other channel reaches cannot be widened because of the proximity of residential development. Therefore, HQUSACE personnel strongly urged that an additional TRC be held early in the Plan Formulation process to insure that potential engineering related flood control channel problems are appropriately addressed. An advance TRC is currently scheduled for late 1992 or early 1993 once sufficient engineering data is generated.

INITIAL PROJECT MANAGEMENT PLAN (IPMP)

The draft Initial Project Management Plan (IPMP) was prepared in conjunction with the preparation of the Reconnaissance Report and appended to the Feasibility Cost Sharing Agreement (FCSA). The IPMP outlined specific work activities that would be accomplished in the feasibility study, including in-kind services.

Coordination Meetings. Several coordination meetings were held between representatives of the Detroit District and the MMSD for the purpose of outlining project features desired by local interests and in-kind services that the local sponsor desired to accomplish in the feasibility study. At these meetings, the sponsor discussed goals and objectives for the entire Lincoln Creek watershed which encompasses the primary Corps of Engineers study area. These goals and objectives included several initiatives which were beyond Corps authority and Federal interest. As such, several sessions were required to educate and reach a consensus with the study sponsor on what initiatives could be addressed in the feasibility study and those that were not subject to cost sharing and required independent investigation by local interests. The interaction and attempts to decipher what initiatives could be a part of the feasibility study were very time consuming and difficult. Some of the primary initiatives desired by the local sponsor were in the area of water quality, recreation, public education, fish and wildlife/wetland enhancement, and crime prevention. As a result of these coordination meetings with the study sponsor and State and local government agencies, the IPMP was adjusted to reflect additional project features and flood control options for the alternatives that are to be investigated in the feasibility study.

Those additional features and alternatives were a result of project goals and objectives developed by the Lincoln Creek Steering Committee, a planning and guidance body established by the sponsor. The primary additional flood control features and alternatives which are being investigated, in part, by local interests through in-kind services include the following:

1) Removal of existing concrete lining materials located above and below the primary project area and replacement with softer channel lining materials. The actual removal of the concrete and associated costs incurred would be the responsibility of local interests.

2) Incorporation of off-line and on-line retention/detention areas in conjunction with the soft channel lining materials.

3) Incorporation of channel meanders, low flow fish channels, terraced creek bank(s), etc., to retain or enhance aquatic life.

4) Additionally, evaluate the effects of Estabrook Dam, located on the Milwaukee River downstream of the project area, on Lincoln Creek flows and sedimentation.

Detention Area. As mentioned previously, the turf lined channel alternative is to include a detention basin. The current location of this detention basin is in Havenwoods State Park, which is located approximately 1-2 miles above the upstream end of the project area. The storage volume of this detention area would be approximately 280 acre-feet. In general, the detention basin would be designed to be filled by gravity and dewatered by gravity. Pumping may be required depending on where outlets would discharge. This review and the potential to add additional off-line and on-line retention/detention basins to this flood control alternative is a task that will be accomplished early in 1993 in the feasibility phase.

Feasibility Study. The IPMP indicated that the feasibility study would complete the plan formulation process. The feasibility report would include a detailed engineering appendix. It is likely that the preparation of feature design memorandums for specific project features, such as bridges, detention/retention areas and other complex structures, will be recommended for completion following the feasibility phase.

Feasibility Study Schedule. The IPMP indicated that the feasibility study is scheduled to be completed within 42 months after execution of the FCSA with the study sponsor and subsequent allocation of Federal and non-Federal funds. The feasibility report itself is scheduled to be completed within 36 months after execution of the FCSA and receipt of study funds.

Feasibility Study Work Activities/Costs. The total cost of the Milwaukee Metropolitan Area Flood study is estimated at $2,100,000. Of this total, the Reconnaissance Study cost was $200,000 and the feasibility study is estimated at $1,900,000. Based on 50-50 cost sharing, the Federal and non-Federal costs of the feasibility study are currently $950,000. However, the study sponsor is interested in and is actively pursuing obtaining the maximum in-kind service credit of 25 percent of feasibility study costs by accomplishing in-kind service work.

ISSUES/PROBLEMS ENCOUNTERED

1) Due to the study sponsor's desire to incorporate additional project purposes in addition to flood control in the flood control project, and its desire to accomplish large scale in-kind services, additional time was required to negotiate the FCSA and IPMP.

2) The Reconnaissance Review Conference memorandum and negotiated FCSA and IPMP were transmitted to HQUSACE for approval and certification by CENCD 19 August 1991, 1st Endorsement to CENCE 10 July 1991 basic memorandum. However, the 2nd Endorsement from HQUSACE providing certification of the Reconnaissance Report was not provided until 10 December 1991.

3) The Detroit District encountered difficulty in preparing Government Scopes of Work for in-kind services that were properly detailed and in a format that the study sponsor could readily understand and enable preparation of detailed proposals. Funds were not adequate near the end of the Reconnaissance phase to enable Government Scopes of Work for in-kind services to be prepared. The result was that additional time was required to conduct coordination meetings and negotiate Government Scopes of Works and corresponding proposals with the study sponsor upon receipt of feasibility study funding.

4) The study sponsor became frustrated and confused concerning the time it takes for the Corps of Engineers to complete the study review process. The study sponsor and other local representatives visited the Chief of Engineers office in an attempt to accelerate the reconnaissance study review process and expedite receipt of certification required to initiate the feasibility study but had little success.

5) Economic General. All feasibility study economic and social analyses will be performed in-house. The local sponsor was unwilling to perform any of the economic analyses. The basic reason for this is that the local sponsor has no expertise deriving flood damages using the Corps flood damage models such as the Structure Inventory Damage (SID) model and Expected Annual Damage model (EAD). This case is also expected to exist with other future feasibility studies.

THE DEVELOPMENT OF THE JOHNSON CREEK EMP

by

James Sherman[1] and Albert O'Connor[2]

INTRODUCTION

From the beginning of our formulation of the Johnson Creek Economic Management Plan (EMP) for the Initial Project Management Plan (IPMP), we have been faced with the challenge and opportunity of implementing "new guidance." This new guidance came to light following the Reconnaissance Review Conference (RRC) in which a HQUSACE memorandum emphasized "the need for task specific detail in the scopes of work portion of the IPMP." This "should be accomplished along the lines of the 'generic IPMP' description." The memorandum also stated that a more "explicit plan for risk analysis must be included in the IPMP."

The purpose of this paper is to provide a brief overview of the project and describe how the generic IPMP (Wilbanks, 1992) format and risk & uncertainty guidance are being incorporated into the analysis. This paper is an attempt to show how we have interpreted and used the guidance, and is not meant as merely a review of the guidance.

PROJECT BACKGROUND INFORMATION

The Johnson Creek feasibility study is a restudy of a flood control project authorized under Section 204 of the Flood Control Act of 1950, PL 81-516, House Document 531, 81st Congress, Second Session. Johnson Creek is located in Portland, Oregon, and vicinity. The creek originates in an agricultural area near Sandy, Oregon, then flows west approximately 25 miles before discharging into the Willamette River at about river mile (RM) 18.5. The Willamette River flows into the Columbia River at RM 101.5. The drainage basin of Johnson Creek lies largely within the service boundaries of the cities of Portland, Gresham, and Milwaukie and Clackamas and Multnomah counties.

Johnson Creek has a 64-year history of flooding. Intense storms are a constant concern to adjacent property owners. Much of the flooding is associated with restricted creek capacity and increased runoff from impervious surfaces related to extensive development in the drainage basin. There are portions of the creek which only have a capacity to pass a 2-year storm event. Consequently, flooding is common during intense storms and may occur more than once during any one season or year.

---

[1]Economic Assistant, Economic Section, Portland District, U.S. Army Corps of Engineers

[2]Civil Engineer, Plan Formulation Section, Portland District, U.S. Army Corps of Engineers

Recent data indicates 15 to 20 percent of the pollution in the Willamette River originates from Johnson Creek. Johnson Creek drains approximately 54 square miles while the Willamette River drains over 11,200 square miles. The Department of Environmental Quality (State of Oregon) has directed the city of Portland to develop a Water Quality Management Plan for Johnson Creek by May 1993.

The first major flood control action on Johnson Creek was performed by the Work Progress Administration (WPA) in 1932-1934. The action consisted of clearing, enlarging and re-aligning various reaches of the creek from the mouth to RM 15.26. The creek banks of much of the lower 10 miles were armored with hand-placed stone on 1V on 1H side slopes. The channel was often used as a disposal site for waste rock.

The Army Corps of Engineers, Portland District, conducted field investigations in 1946 and 1947 to develop House Document 531. Portland District prepared Design Memorandums (DM) in 1958 and 1975. Both DMs proposed a 25-year flood channel. Neither DM was implemented due to a lack of public support and the study was placed on inactive status after each DM. In 1988, the city of Portland requested the Johnson Creek project be reactivated and agreed to sponsor the project.

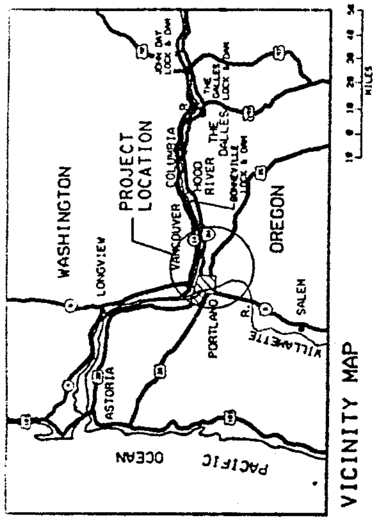
The city has agreed to become the lead sponsor and will coordinate the project with five other local government jurisdictions. These include the cities of Gresham and Milwaukie, Multnomah County, Clackamas County and the Metropolitan Service District.

The preferred plan in the reconnaissance report is 25-year flood protection with a 15-year flood channel capacity and 280 acre-feet of floodwater storage. The other two alternatives considered also provided 25-year flood protection and included a 25-year flood channel and a 10-year flood channel with 400 acre-feet of floodwater storage.

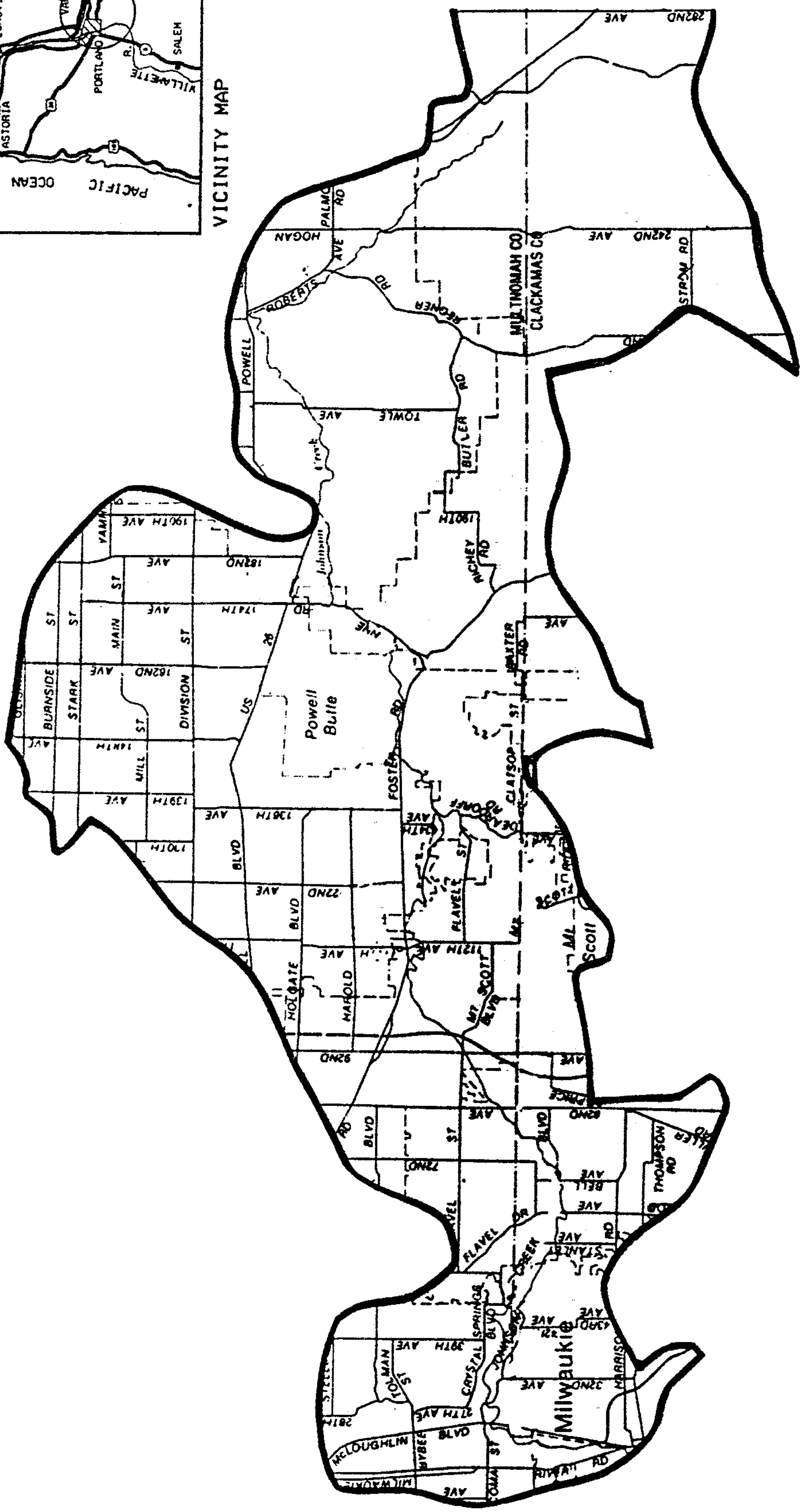
The sponsor continues to demonstrate strong support for the project and has indicated a willingness and financial capability to continue the study on the project.

The feasibility study will evaluate several alternatives to reduce flooding adjacent to Johnson Creek between RM 0.0 and 11.0. The alternatives include six to 12 detention facilities in the upper portions of the drainage basin, detention in conjunction with channel improvements, and a flood warning system.

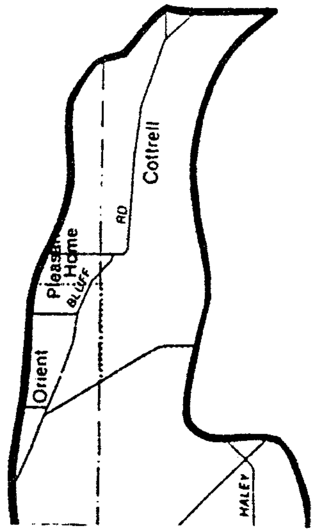
Solutions to improve Johnson Creek water quality will be incorporated in the alternatives for flood control. These solutions could include developing wetlands in the floodwater storage facilities, planting vegetation along the creek and reducing the sediment load in the creek with such provisions as sediment traps, buffer strips and erosion prevention.



WASHINGTON
PROJECT LOCATION
OREGON
PORTLAND
VANCOUVER
ASTORIA
SALEM
PACIFIC OCEAN
VICINITY MAP



MULTNOMAH CO
CLACKAMAS CO
Powell Butte
Milwaukie
Scott



Orient
Pleasant Home
Cottrell

GENERIC ECONOMIC MANAGEMENT PLAN (EMP) FORMAT

Guidance. The draft paper entitled "Methodology Needed in the Development of an Economic Management Plan for an Urban Flood Control Feasibility Study" was provided to us following the RRC. This generic EMP, written by Rayford Wilbanks, is a method for laying out all work requirements by asking simple yet critical, what, why, who, when, and how questions. The purpose of these questions are to assist the economist in developing an EMP with as much foresight as possible. Assuming these basic questions are addressed, the EMP will help better establish roles and responsibilities, tasks and subtasks, issues and concerns. Internal management of the study will also be improved by the EMPs detailed layout of study tasks. The generic IPMP lists the following twelve basic questions that would be a "guide in developing the tasks necessary for economic studies."

1) What tasks are required for economic studies?
2) Why is the task necessary?
3) Who will accomplish each task?
4) When should the task be accomplished?
5) How critical is the task to the economic analysis?
6) How sensitive is the information needed for the task?
7) How will the task be accomplished?
8) What methods should be used to accomplish the task?
9) What information is required to accomplish each task?
10) What information is available?
11) What information will need to be collected or derived?
12) How much time and money should be devoted to each task?

This methodology, as stated in the paper, will also assist in assuring that others who might review the EMP, including our cost sharing sponsors, will be more aware of the tasks, timing , issues and processes of the study. For Johnson Creek, we have attempted to follow the generic EMP as closely as possible. As work on the IPMP continues with the study team and sponsor, the EMP will continue to evolve.

Issues. In attempting to implement the generic format, two basic issues arose. The first issues was, "How do you define the appropriate level of detail in the development of tasks and sub tasks?". Potential EPM formats could range from "historic" one page listing of tasks to an extremely well defined contract scope of work.

Attached is an example single page sample scope of work (SOW) for economic studies of a flood control project (page 5). The overall IPMP for this SOW was represented as a "good example"to the recent Planning Associates and Project Managers program. The SOW conceptually highlights the key components that are required for the analysis but lacks detail in regards to specific tasks, sub tasks and associated costs. It should be noted that the SOW is dated 1990; obviously, IPMP format, purpose, and content have been evolving consistently since that time.

22G Economic Studies.

This subaccount includes studies pertinent to an economic assessment of plans under consideration.

Activity ID	Activity Description
133 - 180	TRC level economic analysis. This activity involves: updating and refining the reconnaissance level flood damage survey of affected properties, including additional study area interviews and verification of first floor elevations; verification of depth/damage curves for properties in the study area; initial development of economic / hydraulic HEC SID/FDA compatible input files for modeling existing, future "with project" conditions, and future "do-nothing" conditions; preliminary calculation of flood control benefits for proposed projects. This will be completed prior to the TRC.
193 - 205	PMP level economic analysis. This activity involves establishing the national economic development (NED) plan and, where applicable, the locally preferred plan. This includes: completing development of HEC SID/FDA model input files; completing calculations of flood control benefits for proposed projects; compute project benefit-to-cost ratios (BCR), net benefits, and incremental benefits to optimize alternative project plans and separable project elements; where applicable, establish cost and benefit allocations among the project purposes involved. This work will be completed prior to approval of the project management plan (PMP).
221 - 280	Refine proposed project economics and BCR's (if necessary) as a result of guidance from the FRC.

A separate economics appendix will be prepared by the Corps for the feasibility report.

The Sponsor will be responsible for assisting Government personnel: (1) during field surveys of and follow-up contacts with property owners and businesses in the sections of the project corridor within their jurisdiction; and (2) projecting future "with" and "without" project conditions in the project corridor . The total work effort by the Sponsor has been estimated at 120 man-hours plus miscellaneous costs.

Federal Work Effort	$ 75,977
Sponsor In-Kind Work Effort	6,531
Total Cost This Subaccount	$ 82,508

For the Johnson Creek feasibility EMP much more detail will be required for the following reasons:

a. CECW RRC guidance explicitly directs us to provide more detail.
b. Hydraulic and Hydrologic data in the reconnaissance study was extremely limited and will experience considerable revisions in the feasibility phase.
c. Alternatives considered have completely changed from those previously analyzed.
d. Recent physical changes within the floodplain may have altered flood plain characteristics.

It is our intent that the EMP should serve as a roadmap to completing the study. The EPM will be referenced throughout the study, helping to ensure that all of the foreseeable requirements are addressed on time and according to budget. This is where the "generic IPMP" is helpful. It provides the structure to identify whatever level of detail is required. By separating all the major tasks into individual tasks rather than groups, we are more able to envision the process, time, and cost of each task. When it is evident that further task sub-division is required, the generic format allows for a consistent display of each task's basic requirements. Ultimately, the level of detail for any EPM will be defined by the comfort level and descriptive capabilities of the author; managements' objectives; and the need to further explain (i.e. defend) cost estimates to nervous study managers. For the Johnson Creek EPM, 6 basic tasks have been defined with 37 subtasks. As work progresses on the IPMP, these tasks may be further modified.

The second issue focuses on the need to better manage anticipated reactions to the expanded EPM format. When confronted with economic SOWs of greater detail and verbosity, the study manager's initial response has been one of alarm and questions. Does more bulk imply more costs, both for the IPMP and feasibility studies? Initially, for Johnson Creek, the costs of the IPMP should be higher that what has been traditionally developed. However, these costs would be expected to decrease over time, on subsequent studies, as planners become more experienced in the process. On the other hand, feasibility study costs should not exceed and will most likely be less than traditionally developed estimates. Improved coordination of tasks and requirements within the EPM framework will assist in preventing unforseen issues from arising later in the study and potentially resulting in costly delays.

We've also dealt with study manager shock by handing out copies of Mr. Wilbanks paper whenever appropriate. To date, the District Economics Section has handed out 30 to 40 copies of the paper along with an explanation of CECW's guidance for the development of the Johnson Creek IPMP. When project managers, study managers and the like, realize that this format allows them a better understanding of individual tasks and requirements and provides the mechanism to hold offices accountable, they should be fully supportive of the process.

Highlights. In general, we feel that the generic IPMP format is a step in the right direction of better planned and managed studies. The basic strength of the format is the questions themselves. They require the analyst to think, formulate, describe, and communicate each task and process and clearly define the requirements. These questions and their application to Johnson Creek are discussed in the following section. Some questions have been modified from the generic IPMP format.

The question of "what" tasks are required for economic studies is fundamental to EMP development and lays out the skeletal structure of the Johnson Creek EMP. All of the other tasks are dependent on having a clear picture of what needs to be done. Although these questions would normally have been asked when preparing any scope of work, the requirement to answer subsequent questions made us look harder at defining the tasks and their interrelationships.

The question of "why?" is both easy and difficult to answer. For some items you can only respond "why ask why?" Most tasks appear to be basic requirements of the study and are necessary to complete subsequent tasks. Formerly, as can be seen in the example SOW shown earlier, tasks were included with no clear definition of purpose. However, the need to clearly define tasks and work closely with the sponsor require us to look more thoroughly at the "why" for all tasks. This assures their understanding of the process and data requirements and allows them to more fully participate in in-kind services. This added explanation of "why" will also help the reviewer understand the purpose of each task and thus help to avoid questions or concerns later in the study. One example in the Johnson Creek study would be structure value analysis. This analysis would compare assessed values determined in the reconnaissance report with the replacement cost less depreciation for a limited sampling of structures. This will help to quantify the possible error associated with using assessed values. These results will be used in the risk and uncertainty model to include the element of uncertainty for structure values. Thus the probability distribution will reflect this uncertainty. By explaining why we will be analyzing the accuracy of the assessed values, we are letting reviewers and the sponsor know in advance the purpose of this task.

When asking the question of "who will accomplish each task?", we felt it was also important to ask "who we will be coordinating with to accomplish each task"? A brief description of the information to be exchanged will also be included. These questions allow us to visualize the flow of information required for each portion of the study. A good example for Johnson Creek where information exchange is critical and identification of the "who" is important is in the development of a depth-damage model. The timing of this item is dependent upon receiving stage-frequency information from Hydraulics and Hydrology.

The question of "when?" is also important in defining a network "flow chart" for completing economic studies. Accurate depiction of when information is required helps better define the dependencies on other offices and illuminates potential critical path tasks. For the Johnson Creek analysis, the development of the depth-damage model is again a good example of the importance of this question. The final completion of any depth-damage model is dependent upon when all other inputs are to be completed (i.e., stage-frequency and structure valuation analysis).

The question of sensitivity plays a key role in the development of our risk and uncertainty analysis. Guidance requires risk and uncertainty analysis in flood control studies. In addition, the HQUSACE memorandum following the RRC stated that a more "explicit plan for risk analysis must be included in the IPMP." In the EMP, each task is being reviewed to determine what items are sensitive, what types of parameters might be included, and how each item relates to overall risk and uncertainty. If risk and uncertainty is held off until later in the study, it would be a more costly endeavor. Extra time would be required to determine areas of sensitivity after data development, rather than focusing in on them as the data is developed. Later in this report we will look more closely at how we will handle risk and uncertainty.

The following three questions form the basis for a kind of shopping list of information requirements for each task for the Johnson Creek Study.

1. What information is required to accomplish each task?
2. What information is available?
3. What information will need to be collected or derived?

The last two questions determine whether an item fits into the category of "have" or "have not," (i.e., checking off the shopping list). As can be seen in the following example of the task of "structure classification", the last two questions when summed up should completely describe the information requirements. The second question gives us the opportunity to step back, look at what work was completed in the Johnson Creek reconnaissance report, and identify gaps in data. Without questioning data availability at this level, the awakening of this "data gap" could possibly occur at a critical time in the feasibility study (example: missing data from the reconnaissance report).

One of the more difficult questions to answer in the development of the EMP is, "how will the task be accomplished and what methods will be used?" This item may be easy to determine if standard methods are implemented or the item fits into a standard response (i.e., the determination of first floor elevation, determination of residual damages, etc.). However, some items in the Johnson Creek study were not addressed in the reconnaissance report and project alternatives have drastically changed. Items like recreation, mitigation, and water quality have been added, but a clear definition of their relationship to the project has not yet been determined. The problem that arises is determining what level of detail is needed to describe the "how to" without having actually begun the feasibility study.

<u>Task Example</u>. The following section provides an example of how we are using the generic format to define a specific study task. This example consists classification of structures following the initial identification of structures.

1) <u>Structure Classification</u>. A classification of individual structures should include all pertinent data for that structure. All items can be completed in the same survey.

    a) <u>What task is to be completed</u>? Determine structure class (i.e., residential, commercial/industrial, special, etc.), type of construction (brick, frame, slab, one story with basement, one story, without basement, split level, etc.). Structures will be associated with individual reach locations. Addresses of structures will be recorded and used to determine structure value from the Assessor's records. First floor elevations will be identified.

b) Why is this task be required? Information is required to evaluate flood damages. Damages associated with flood events are dependent on the class of the structure, its type, and its value. Given the results of the reconnaissance report, structure and content damage account for 92 percent of all without-project condition damages, and 98 percent of all residual damages. This would indicate that a thorough and accurate analysis of structures is required.

c) Who is responsible for completing this task? Portland District Economic Section

d) When should this task be accomplished? In order to identify the limits of the floodplain, this task should follow Hydraulics and Hydrology studies. The flow chart on page 10 illustrates the location of this task in relation to the other tasks required for basic structure/content damage analysis.

e) How Will the Task be Accomplished? One hundred percent of structures within the 100-year floodplain have or will be visually surveyed. A determination of each structures class and type will be obtained. First floor elevations will be estimated using the best available mapping (2' contours) along with visual inspection.

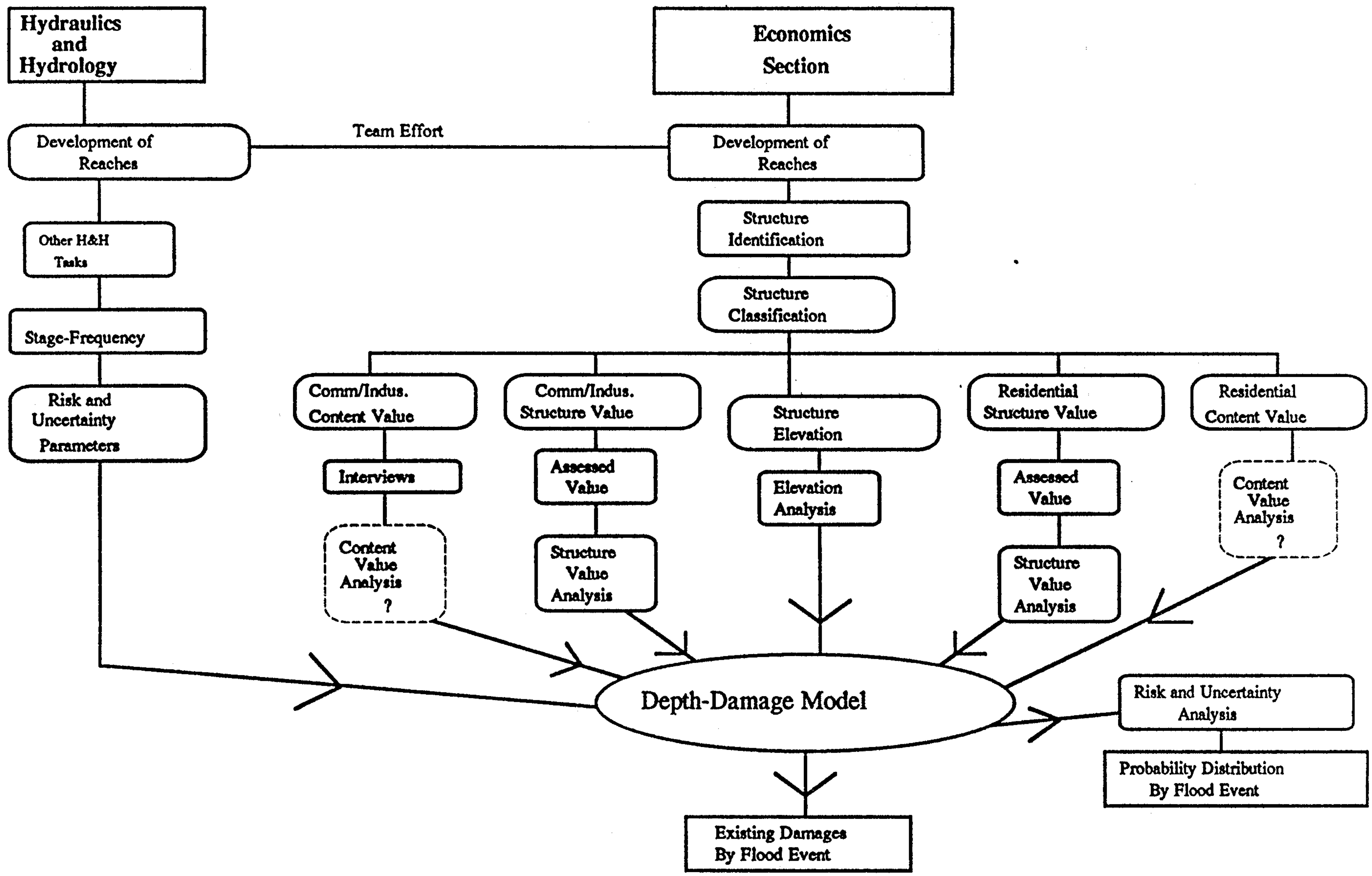
f) How much data is available? One hundred percent of the structures within the 100-year floodplain (excluding new development) were categorized in the reconnaissance report.

g) How much additional data are needed? Additional development and structures between the 100-year and 500-year floodplain and above RM 8.5 will need to be surveyed. It is estimated from the reconnaissance report that approximately 60 structures may lie between the 100-year and 500-year floodplain.

h) How sensitive is the information needed in this task? First floor elevations are extremely sensitive to the maps used and the visual estimates made. Elevations in the reconnaissance report were visually estimated from topographic maps with 2-foot contour lines, with error of ±1.18 feet, as determined in the draft risk analysis guidance (USACE, 1992). As was discussed above, over 90 percent of damages for the with- and without-project conditions were the result of damages to structures and contents. Therefore, a clear analysis of the sensitivity of structure classification is critical to the overall study.

Structure/Content Damage Analysis Flow Chart. The flow chart on page 10 is a visual representation of the steps required to determine damages to structures and contents for each flood event.

Johnson Creek Structure/Content Damage Analysis



RISK AND UNCERTAINTY

Guidance. Risk and uncertainty analysis is increasingly being used in economics flood reduction studies. Recent guidance specifically states that "all flood damage reduction studies will adopt a risk-based analysis framework" and will be "developed to the task level and included in the Initial Project Management Plan" The HQUSACE memorandum following the RRC also specifically requested a more detailed listing of risk analysis in the EMP. In light of this new guidance (draft guidance titled "Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies), the risk and uncertainty portion of the EMP requires a more critical analysis.

Estimates made in flood control studies are inherently subject to errors. Each individual error in measurement, when combined with the overall stage-damage relationship, can result in an estimate of flood damage reduction benefits which is significantly in error. A risk and uncertainty analysis is designed to help quantify the error in flood damage estimates and thus make it possible to develop a probability distribution for expected annual flood damages and flood damage reduction benefits associated with a project.

Implementation. In addressing this issue for Johnson Creek, we are attempting to visualize all possible sensitive areas (as discussed previously). The following is an excerpt of some of the questions and answers from the Johnson Creek EMP.

1) Why is this task required? Factors that are critical to the recommendation of a plan, but are not known with certainty, must be subject to analyses which reveal the nature and particularly the consequences of their uncertainty.

2) Who will accomplish this task? Portland District Economic Section.

3) When will this task be accomplished? This task shall be accomplished from the beginning of the study to the final benefit-cost analysis.

4) How is this task to be accomplished? All variables that are to be included in the final analysis should be individually analyzed to ascertain their inherent uncertainties. All major items to be analyzed should have been identified before the start of the feasibility study. All uncertainties should be clearly documented in the report. The final benefit-cost analysis should include a simulation which takes into account all of these variables along with their uncertainties.

5) How much data is available? There are currently no data available on risk and uncertainty for the Johnson Creek study.

6) How much additional data are needed? Data for risk and uncertainty analysis for Johnson Creek include the following:

    a) Risk and uncertainty outputs from Hydraulic and Hydrology risk and uncertainty studies for inclusion into the economic model.

b) An analysis of the error in measurement of first floor elevations. Output to be used to determine standard deviation of first floor elevations.

c) An analysis of the variability of structure valuation as determined in the structure valuation analysis.

d) Survey a sample of residences to determine variability in structure/content valuation.

The following example demonstrates use of risk and uncertainty for first floor elevations, structure values, and Hydraulics and Hydrology data.

Risk and uncertainty functions will be incorporated into the depth-damage model. The standard deviation for first floor elevation was estimated at 0.60 feet for the 2-foot contour maps used in this study, as illustrated in the following table excerpted from the draft risk analysis guidance (USACE, 1992). A risk analysis of structure values was not conducted during the reconnaissance phase. Therefore, for demonstration purposes, structure values with uncertainty are based on a truncated triangular distribution, truncated at the mean value and with a maximum value of 40 percent above the mean. Based on prior Corps studies, values of structures based on replacement cost less depreciation have been found to be up to 40 percent greater than assessed values for certain areas. Therefore, fore this example we will assume values will not exceed 40 percent. Stage-frequency values have been set at a normal distribution with standard deviation of .1 feet. As of press time, actual model data had not yet been developed. Structure plan, value, and elevation are taken from the reconnaissance report. Hydraulics and Hydrology data and structure value variability are mere guesses.

Method	Contour Interval (feet)	Error[1] (feet)	Standard Deviation[2] (feet)
Field Survey			
Hand Level	NA	±0.2 @ 50'	0.10
Stadia	NA	±0.4 @ 500'	0.20
Conventional Level	NA	±0.05 @ 800'	0.03
Automatic Level	NA	±0.03 @ 800'	0.02
Aerial Survey	2'	±0.59	0.30
	5'	±1.18	0.60
	10'	±2.94	1.50
Topographic Map	2'	±1.18	0.60
	5'	±2.94	1.50
	10'	±5.88	3.00

Excerpted from draft guidance "Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies, August 1992

[1]Errors for aerial survey and topographic maps are calculated at 99% confidence level, assuming the deviations from the true elevation are normally distributed with zero mean and indicated standard deviations.
[2]Standard deviation for field survey assumes that error represents a 99% confidence interval and assuming Normal distribution

The economic model which was developed to measure the economic impacts of alternative scenarios employs spreadsheet software (Microsoft Excel) and @Risk (Palisade, 1988), a risk analysis software package. The model uses a simulation process to project an array of events which can be expected to occur over given periods of time. This approach uses Monte Carlo-type random number generation to estimate an expected value given a combination of probabilities and events. An example of a section of the spreadsheet is included on page 15. The example contains the basic input and output characteristics for a single iteration of the @Risk program. For each iteration of the simulation, the program inputs a value for stage-frequency that fits into the given parameters. It then inputs both a structure value and first floor elevation that are confined within their parameters. A resulting total damage for each flood event is calculated. The results are then stored. The @Risk program sums the results of the multiple iterations of the simulation and produces expected values and variance. The table and graphs that follow that are the result of a limited attempt to demonstrate how these elements of risk and uncertainty would be presented in an economic risk and uncertainty analysis.

As can be seen on the simulation statistics (page 17), a distribution of minimum, mean, and most likely damages can be associated with the three possible locations of error included in the risk and uncertainty analysis.

For demonstration purposes, these damages can be compared to the results of the reconnaissance report. Estimated residential damage for without project condition at reach 4 was estimated as follows:

Reconnaissance Report

2-Year Flood Event	5-Year Flood Event	10-Year Flood Event	25-Year Flood Event	50-Year Flood Event	100-Year Flood Event	500-Year Flood Event
$0	$6,220	$58,271	$372,289	$828,742	$933,550	$1,094,920
					Total	$3,293,992

Mean Result of Risk Analysis

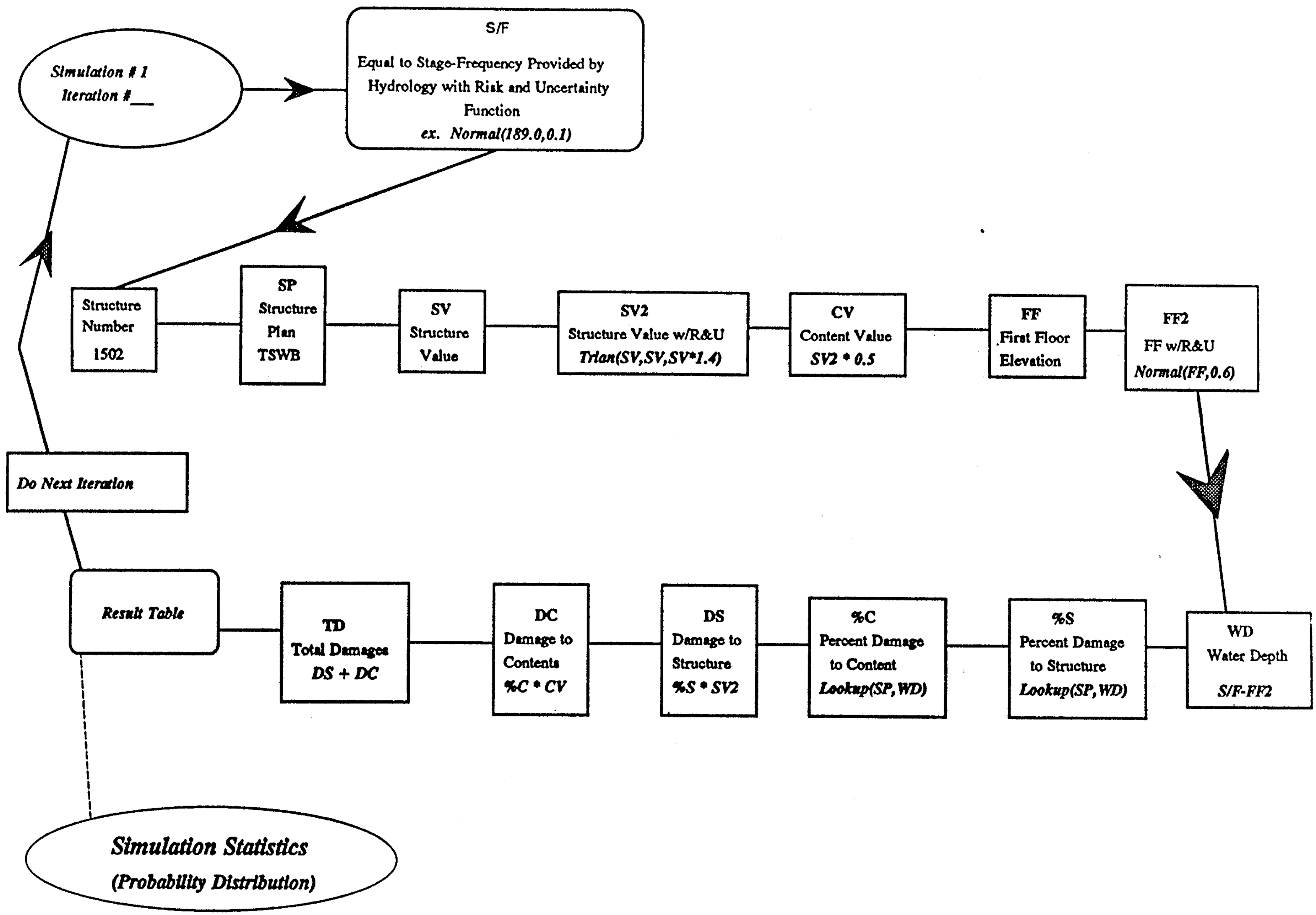
2-Year Flood Event	5-Year Flood Event	10-Year Flood Event	25-Year Flood Event	50-Year Flood Event	100-Year Flood Event	500-Year Flood Event
$3	$7,194	$69,237	$412,562	$882,048	$1,036,479	$1,242,433
					Total	$3,649,956
			Percent Difference			
≈0%	15%	18%	11%	6%	11%	13%

Average annual damages for the without project conditions at reach 4 amounted to $46,010. Average annual damages developed following the risk analysis amounted to $51,009. This equates to an increase in damages of over 10.8 percent. This can be associated directly with the uncertainty in structure value, along with its associated uncertainty in content values.

REACH 4 WITHOUT PROJECT CONDITIONS

25-yr Structure Number	Event Structure Plan	Structure Value	Structure Value w/ R&U	Content Value	First Floor Elevation	First Floor Elevation W/R &U	Water Depth	Percent Damage to Structure	Percent Damage to Contents	Damage to Structure	Damage to Contents	Total Damages
1500	TSWB	$22,700	$25,727	$12,863	197.2	197.2	-1.2	7.3%	0.0%	$1,871	$0	$1,871
1501	OSWB	$17,600	$19,947	$9,973	197.2	197.2	-1.2	7.3%	0.0%	$1,451	$0	$1,451
1502	OSWB	$22,000	$24,933	$12,467	196.7	196.7	-0.7	8.9%	0.0%	$2,222	$0	$2,222
1503	OSWB	$20,400	$23,120	$11,560	196.7	196.7	-0.7	8.9%	0.0%	$2,060	$0	$2,060
1504	TSWB	$13,800	$15,640	$7,820	195.7	195.7	0.3	12.1%	14.7%	$1,899	$1,149	$3,048
1505	OSWB	$24,100	$27,313	$13,657	199.7	199.7	-3.7	0.0%	0.0%	$0	$0	$0
1506	OSWB	$13,800	$15,640	$7,820	197.2	197.2	-1.2	7.3%	0.0%	$1,138	$0	$1,138
1507	OSWB	$20,200	$22,893	$11,447	200.7	200.7	-4.7	0.0%	0.0%	$0	$0	$0
1508	OSWB	$18,700	$21,193	$10,597	202.2	202.2	-6.2	0.0%	0.0%	$0	$0	$0
1509	TSWB	$33,400	$37,853	$18,927	201.7	201.7	-5.7	0.0%	0.0%	$0	$0	$0
1510	TSWB	$21,400	$24,253	$12,127	201.2	201.2	-5.2	0.0%	0.0%	$0	$0	$0
1511	OSNB	$23,100	$26,180	$13,090	197.2	197.2	-1.2	0.0%	0.0%	$0	$0	$0
1512	OSNB	$23,100	$26,180	$13,090	196.2	196.2	-0.2	0.0%	0.0%	$0	$0	$0
1513	OSNB	$17,600	$19,947	$9,973	194.2	194.2	1.8	19.2%	16.4%	$3,829	$1,640	$5,469
1514	OSNB	$20,000	$22,667	$11,333	194.2	194.2	1.8	19.2%	16.4%	$4,352	$1,864	$6,215
1515	TSWB	$25,300	$28,673	$14,337	202.2	202.2	-6.2	0.0%	0.0%	$0	$0	$0
1516	TSWB	$26,400	$29,920	$14,960	199.2	199.2	-3.2	0.0%	0.0%	$0	$0	$0
1517	TSWB	$27,500	$31,167	$15,583	198.2	198.2	-2.2	0.0%	0.0%	$0	$0	$0
1518	TSWB	$25,800	$29,240	$14,620	195.2	195.2	0.8	14.3%	20.5%	$4,178	$2,999	$7,177
1519	TSWB	$25,500	$28,900	$14,450	194.2	194.2	1.8	19.6%	29.7%	$5,675	$4,289	$9,964
1520	OSNB	$15,000	$17,000	$8,500	195.2	195.2	0.8	12.4%	9.8%	$2,103	$830	$2,933
1521	OSNB	$20,900	$23,687	$11,843	195.2	195.2	0.8	12.4%	9.8%	$2,930	$1,157	$4,086
1522	OSNB	$19,800	$22,440	$11,220	194.2	194.2	1.8	19.2%	16.4%	$4,308	$1,845	$6,153
1523	OSNB	$11,600	$13,147	$6,573	198.2	198.2	-2.2	0.0%	0.0%	$0	$0	$0
1524	TSWB	$24,200	$27,427	$13,713	200.2	200.2	-4.2	0.0%	0.0%	$0	$0	$0
1525	OSNB	$37,000	$41,933	$20,967	198.2	198.2	-2.2	0.0%	0.0%	$0	$0	$0
1526	OSNB	$38,000	$43,067	$21,533	195.7	195.7	0.3	9.4%	8.2%	$4,054	$1,774	$5,828
1527	OSNB	$18,000	$20,400	$10,200	198.2	198.2	-2.2	0.0%	0.0%	$0	$0	$0
1528	OSNB	$18,000	$20,400	$10,200	198.2	198.2	-2.2	0.0%	0.0%	$0	$0	$0
1529	TSNB	$31,600	$35,813	$17,907	199.7	199.7	-3.7	0.0%	0.0%	$0	$0	$0
1530	TSNB	$41,300	$46,807	$23,403	199.2	199.2	-3.2	0.0%	0.0%	$0	$0	$0
1531	TSNB	$41,300	$46,807	$23,403	199.2	199.2	-3.2	0.0%	0.0%	$0	$0	$0
1532	TSNB	$41,300	$46,807	$23,403	198.2	198.2	-2.2	0.0%	0.0%	$0	$0	$0
1533	TSNB	$41,300	$46,807	$23,403	199.2	199.2	-3.2	0.0%	0.0%	$0	$0	$0
1534	TSNB	$41,300	$46,807	$23,403	199.2	199.2	-3.2	0.0%	0.0%	$0	$0	$0
1535	TSNB	$41,300	$46,807	$23,403	199.2	199.2	-3.2	0.0%	0.0%	$0	$0	$0

Risk and Uncertainty Analysis

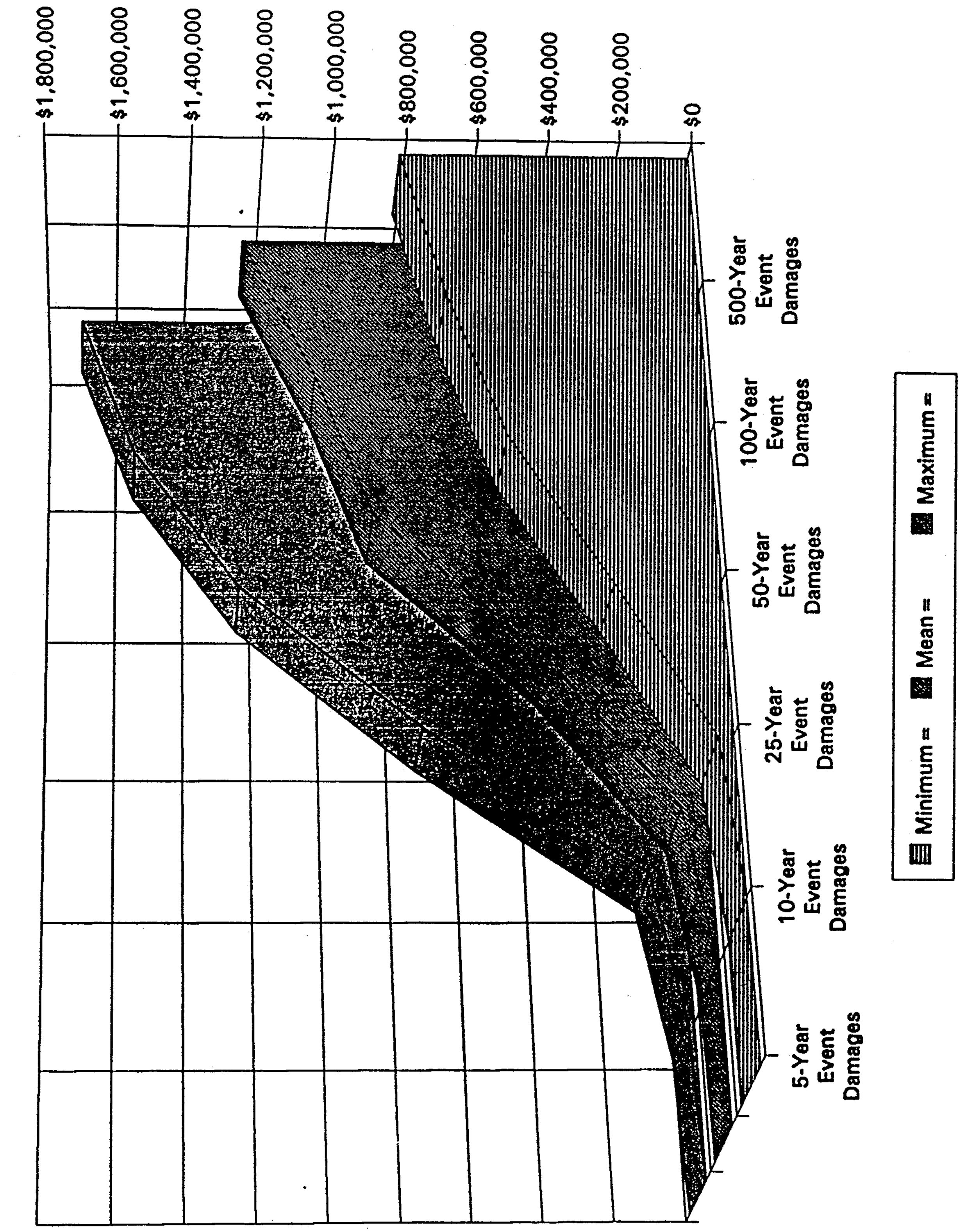


Risk Analysis Simulation Results

Simulation Statistics
Date: 9/14/92 at 12:07
Iterations: 500
Simulations: 1

Worksheet:	DAMPRGR2.XLS						
Output Range:	2-Year Event Damages	5-Year Event Damages	10-Year Event Damages	25-Year Event Damages	50-Year Event Damages	100-Year Event Damages	500-Year Event Damages
Cell:	M182	M353	M523	M692	M861	M1030	M1199
Minimum =	$0	$0	$39,968	$281,642	$546,250	$699,311	$814,339
Mean =	$3	$7,194	$69,237	$412,562	$882,048	$1,036,479	$1,242,433
Maximum =	$1,523	$16,479	$93,779	$723,381	$1,244,009	$1,547,271	$1,702,934
Std Deviation =	$68	$3,278	$8,799	$76,587	$148,235	$144,975	$136,056
Variance =	4.63E+03	1.07E+07	7.74E+07	5.87E+09	2.20E+10	2.10E+10	1.85E+10
Skewness =	22.29	0.16	0.10	1.32	-0.06	-0.30	-0.45
Kurtosis =	498.00	2.67	2.80	5.52	2.01	3.04	4.08
Percentile Values							
5Perc =	$0	$2,034	$55,013	$323,738	$661,937	$759,071	$967,203
10Perc =	$0	$2,837	$57,222	$333,118	$685,052	$806,958	$1,084,524
15Perc =	$0	$3,599	$59,918	$339,376	$703,000	$835,097	$1,132,678
20Perc =	$0	$4,260	$61,570	$346,226	$719,657	$905,661	$1,154,670
25Perc =	$0	$4,877	$63,119	$350,595	$743,163	$971,231	$1,171,089
30Perc =	$0	$5,374	$64,372	$358,296	$763,351	$996,291	$1,186,178
35Perc =	$0	$5,782	$65,682	$363,618	$783,606	$1,011,602	$1,198,693
40Perc =	$0	$6,302	$67,010	$370,143	$853,602	$1,029,227	$1,214,092
45Perc =	$0	$6,674	$67,971	$386,363	$883,097	$1,042,060	$1,229,746
50Perc =	$0	$7,069	$69,013	$405,747	$907,817	$1,055,939	$1,246,441
55Perc =	$0	$7,501	$69,830	$418,934	$932,160	$1,069,690	$1,262,698
60Perc =	$0	$7,946	$71,176	$431,286	$949,715	$1,083,526	$1,277,229
65Perc =	$0	$8,278	$72,488	$440,630	$966,031	$1,098,919	$1,291,255
70Perc =	$0	$8,959	$73,968	$448,417	$977,892	$1,116,359	$1,310,419
75Perc =	$0	$9,578	$75,181	$454,680	$994,952	$1,128,011	$1,330,306
80Perc =	$0	$10,101	$76,821	$461,666	$1,013,442	$1,146,203	$1,352,807
85Perc =	$0	$10,561	$78,486	$472,345	$1,031,027	$1,167,156	$1,370,014
90Perc =	$0	$11,468	$80,527	$488,134	$1,065,281	$1,202,237	$1,398,042
95Perc =	$0	$12,664	$84,680	$543,740	$1,101,818	$1,230,806	$1,447,920

Johnson Creek Reach 4 Damages



CONCLUSIONS

Since the Johnson Creek Economic Management Plan is still in its formulative stage, a conclusion of the effectiveness of our implementation of the new guidance is to early to call. With review and close inspection it may be seen that we are either too detailed or still not detailed enough. Either way, these two new guidances are at least a step in the right direction. During the formulation of the EMP, the "generic IPMP" is relied on heavily for two reasons: (1) "Headquarters told us to"; and (2) it just makes more sense for any study of any magnitude to be better planned from start to finish. The Johnson Creek EMP will be referenced and utilized throughout the study. Making it a more useful tool will only help to enhance the actual feasibility study.

The only difficulty with the new guidance is just that. Change is difficult, and any change is likely to meet resistance from a broad spectrum of individuals. The fear of increasing costs in the IPMP stage is going to be hard to swallow (as we experienced with the responses from our study managers). Many have the view that brevity is the mother of thriftiness. More guidance is required for those actually coordinating the overall IPMP. Their fears need to be alleviated to smooth the way for future EMPs.

All problems considered, the "generic IPMP" was a useful tool. The less stumbling in the dark that is required to develop these management plans, the greater the cost savings will be to the government and our sponsors on all projects. And, in light of cost sharing, a more detailed plan provides the sponsor with a better understanding of exactly what they are paying for.

The new risk and uncertainty guidance is also a step in the right direction. Development of the EMP would have been considerably more difficult without this guidance. Traditionally, Hydraulics and Hydrology and Economics have not developed a joint risk and uncertainty analysis. Under this new guidance, both analyses could meld into a more comprehensive package. More guidance to all members of the study process will help to alleviate any possible confusion about or mistrust of risk and uncertainty analysis. Thus allowing them to understand the purpose in analyzing the critical elements of a study.

REFERENCES

Palisade Corporation; @Risk, Risk Analysis and Simulation Add-in for Excel Users Guide, March 1988

U.S. Army Corps of Engineers, Draft Guidance "Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies), August 1992

Wilbanks, Rayford, Economist, U.S. Army Corps of Engineers, Vicksburg District; "Methodology Needed in the Development of an Economic Management Plan for an Urban Flood Control Feasibility Study, June 1992

HYDROLOGIC ENGINEERING FOR THE IPMP

by

Gary R. Dyhouse[1]

INTRODUCTION

Hydrologic engineering studies must be well defined and planned, given today's climate of cost sharing with a local sponsor and tight control of available funds. Historically, the Corps has had difficulty in accomplishing necessary planning and engineering studies for the time and funds originally estimated. In many cases, this difficulty is caused by a lack of communication between key members of the study team, by the failure to recognize the proper methods and procedures necessary to analyze the specific problem, or by the expansion of the project scope, or alternatives to evaluate, without commensurate increases in funds to perform these additional activities. In the past, it was not unusual for the Corps to go back to Congress for more money to complete the feasibility study or the detailed technical analysis. Today, however, the local sponsor must cost share these occurrences; a situation that can cause embarrassment to the Corps and reflect poorly on its engineering management reputation. The need for a cost sharing partner for Corps studies and reports mandates that technical management of study time and costs be improved.

Although all engineering analyses are important, hydrologic engineering is a critical item in Corps studies, especially for feasibility investigations. The hydrologic engineering study product must satisfy local sponsor and study team needs. It must also be completed within available financial resources. The only way to accomplish the study effort within budgetary constraints is to adequately scope and plan the effort prior to initiation of the work. This effort is extremely important to the initial project management plan (IPMP). The development of a proper hydrologic engineering management plan for the study is necessary to accomplish these objectives.

A HYDROLOGIC ENGINEERING MANAGEMENT PLAN

The hydrologic engineering management plan (HEMP) is a technical outline of the hydrologic engineering studies necessary to successfully formulate a solution to a particular water resource problem. A HEMP could be an initial or detailed work outline. An initial HEMP would be developed to define key issues and activities sufficient to address study time and cost. A detailed HEMP would outline all significant technical studies sufficient for the responsible engineer to perform the analysis from start to finish. The hydrologic engineering management plan may be in as much or as little detail as the responsible hydraulic engineer deems appropriate to manage and conduct the technical investigation. However it must be in sufficient detail to describe the hydrologic activities and accurately estimate time and cost for the IPMP.

---

[1] Chief, Hydrologic Engineering Section, St. Louis District, USACE

Use. The use of a hydrologic engineering management plan is twofold. It is:

1) a basis for firm time and cost estimates. Accurate estimates cannot be obtained without taking sufficient time to develop firm and justifiable estimates for the feasibility or PED phase. The HEMP should reflect the hydrologic information needs of the study team and define the method of proceeding through the entire hydrologic study process. In addition, agreement between hydrologic engineering and planning or project management on the number of different alternatives and the sizes of each must be reached for an accurate cost estimate. The HEMP should be viewed as a "contract" between hydrologic engineering and planning or project management to perform the stated work for the agreed upon amount of funds and time. Additional work required of hydrologic engineering must be accompanied by additional funds. Written records and daily or weekly logs of accomplishments are important to properly manage and track the study time and fund expenditures throughout the study.

2) a technical guide for the hydraulic engineer. Many feasibility or PED investigations require two years or more of hydrologic engineering effort. Even an experienced hydraulic engineer cannot foresee all facets of a multi-year hydrologic engineering study without significant work planning on his or her part and without input from others. A detailed technical outline allows the engineer to work effectively and efficiently, without close supervision. Participating in the preparation and use of a HEMP can greatly help inexperienced hydraulic engineers, providing a clearer understanding of the overall analysis procedures and reporting process.

Personnel Involved. The HEMP is a hydrologic engineering document, usually prepared by the responsible hydraulic engineer. It is not required or approved by planning, project management, or any other discipline, but must incorporate the information needs of all disciplines. Consequently, the hydraulic engineer is the most important player in its development, but is not the only player. Other personnel having input to the plan include:

- Senior hydraulics personnel--the initial HEMP may actually be prepared by an experienced hydraulic engineer or a section chief to insure the time and cost estimate is adequate and that it fully addresses all study issues. A hydraulic engineer preparing a HEMP should have his/her supervisor provide an effective review and critique.

- Study manager--the hydraulic engineer should obtain the views of the study manager on the alternatives to be addressed, level of detail, number of iterations for each alternative, combinations of different alternatives, preliminary milestone dates and other pertinent information.

- Economist--similarly, the views of the economist are important in establishing the type of analysis which may be required. Significant agricultural damages would require knowledge of the time of year the flood occurs, likely requiring a continuous simulation model. A study area with primarily urban damages could allow the use of an event model. Information on damage reaches is necessary to estimate the location of hydrologic computation points to give stage-frequency information at necessary damage centers. The information needs of planning and economics play a large part in the development of the HEMP.

- Local sponsor--the sponsor almost always has useful hydrologic information on the study area. In addition, the sponsor may have definite views on the alternative and level of protection which he views as most suitable for the investigation. While this information does not lock in the final result, it does require analysis during the hydrologic investigation.

- Cost estimator, realty specialist, structural, geotechnical, and mechanical engineers, regulatory personnel, the recreational planner, environmental biologist, etc. may all need specific information from the hydraulic engineer.

- Review authority--controversial, complex or very costly hydrologic analyses should be discussed with Division and possibly HQUSACE hydrologic personnel to confirm the plan of attack and procedures proposed. This could be accomplished both informally and through the mandatory technical review conference during the reconnaissance phase.

Initial and Detailed HEMP. The initial HEMP should broadly outline the hydrologic and hydraulic activities for the feasibility investigation, needed for the initial project management plan (IPMP), or for the detailed project design, needed for the project management plan (PMP). The initial HEMP should be prepared at the end of the reconnaissance study so that time and funds needed may be firmly estimated for the feasibility report. Similarly, an initial HEMP would be prepared at the end of the feasibility report to establish hydrologic engineering time and costs necessary for the preconstruction engineering and design phase (PED). Detailed HEMPs would be prepared at the beginning of the feasibility phase, to detail all hydrologic engineering work necessary during feasibility, and at the start of PED for the balance of the hydrologic engineering effort. It is assumed that both initial and detailed HEMPs will be prepared, but this does not mean that both are always required. In fact, if a detailed hydrologic engineering management plan can be developed at the end of the reconnaissance phase in lieu of an initial plan, it should be done. A detailed HEMP at this level should further improve the time and cost estimate for the next phase.

SCOPING THE INVESTIGATION

A preliminary assessment should be made to gain an understanding of the key issues and concerns to be addressed in the analysis. This assessment leads to an initial hydrologic engineering management plan, based on the main considerations of the study. The initial HEMP must address all key areas of concern sufficient to prepare an adequate time and cost estimate. These subjects include:

Study Objective. The major study objectives should be defined; flood damage reduction, navigation, water supply, environmental restoration, water control, hydropower, etc. Geographic scope of the study should be determined and key locations requiring hydrologic information specified. Preliminary hydrologic engineering requirements and strategies to accomplish these objectives may be postulated.

Major Issues. The initial HEMP must outline the information and methods necessary to address the major issues of the hydrologic engineering study. Methods and procedures needed to address complex or precedent-setting problems, sensitive environmental concerns, use of outside consultants (including Corps labs), local sponsor requirements, the need for new physical or analytical model development, adverse affects caused by a potential project, etc. would be scoped for budgeting purposes.

Level of Detail. Although the study phase will usually establish the overall level of detail, the interdisciplinary planning team (IPT) must be queried to obtain their ideas on the hydrologic information they need. However, the hydrologic engineering effort often plays the largest role in determining the level of detail. Depending on the appropriate study costs, several iterations between the hydraulic engineer and the study manager may be necessary to establish a level of detail commensurate with the level of study funding. Although these iterations will result in increased hydrologic planning costs, the development of a detailed plan of attack prepared at the start of the study should minimize any later "wheel-spinning" and result in a more efficient and effective progression of the study. Adequate planning at the start of the study may result in lower overall hydrologic engineering costs.

Hydrologic Information Availability and Requirements. Data bases would be examined to determine the rainfall, streamflow, topographic and other records available for the particular study. The need for establishing a limited data collection program to address the objectives of the study would be determined. Existing Federal and non-Federal projects (reservoirs, levees, water withdrawals, etc.) affecting the analysis would be determined.

Unusual Features. Items peculiar to the study area which require additional hydrologic engineering effort must be addressed, especially if the work is necessary in the feasibility investigation.

- flat slopes and wide floodplains could require a one or two-dimensional unsteady flow analysis, resulting in significant higher study costs compared to using simpler models.

- major quantitative sedimentation investigations may be necessary to firmly establish project feasibility. Reservoirs and extensive channel modifications may require significant quantitative sediment investigations during the feasibility phase.

- lake stage-frequency analysis in closed basins, that do not drain to a downstream watershed.

- complex reservoir systems problems in which political or environmental issues mandate extensive and unusual systems modeling.

- unstable rating relationships, complex interior flood control studies, multi-reservoir analyses, and other difficult water resource analyses must be recognized and evaluated during the early planning process leading to a HEMP.

Studies having unusual features and complex analyses could benefit from peer review. HQUSACE has established a peer review procedure through the HQUSACE-sponsored Hydrology Committee, with membership consisting of selected senior hydraulic engineers from Districts and Divisions. The Hydrology Committee will meet with District personnel to review the study/project and offer suggestions on the District's plan of analysis. The District incurs no cost for committee participation. Separate committees on Channel Stabilization, Tidal Hydraulics and Water Quality are also available for assistance on unusual features in these areas. ER 15-2-14 further describes these four committees.

Study Boundaries. The HEMP must distinguish between study boundaries and project boundaries in the development of estimates. Project effects often extend far upstream and downstream on the main stem of the study stream, as well as up tributaries. Proposed projects may change the flood hydrology and sediment regime throughout the watershed, not just near the proposed project. Changes in water control management practices at Corps reservoirs can also affect interests remote from the reservoir site. The hydrologic analysis must include the evaluation of all positive and negative effects of a potential project or water control management change throughout the stream system, or study area.

Likely Alternatives. The screening process used in the reconnaissance phase should result in two or three alternatives to evaluate in detail to determine a national economic development (NED) plan during the feasibility phase. The HEMP will include the most practical alternative(s) or combinations of alternatives to estimate the cost of the hydrologic engineering work effort. The major with-project scenarios must be developed with the IPT for both preliminary and final scoping of the technical activities. The no-action case must also be determined for comparison to the with-project alternatives.

KEY HYDROLOGIC ACTIVITIES IN IPMP DEVELOPMENT

A typical strategy would first include a preliminary assessment, identifying the problems and issues described in both this section and the previous section. This assessment would result in the preparation of an initial hydrologic engineering management plan, sufficient to scope time and funding requirements. The initial HEMP would include appropriate contingencies to establish total hydrologic engineering cost for inclusion in the initial project management plan or in the PMP. The activities in this and the preceding paragraphs are summarized in Figure 1.

Field Inspection. An early field inspection is necessary to become familiar with site-specific problems that must be incorporated in the HEMP. A continuous field presence should be maintained throughout the study to keep pace with changes to the study area. Field inspection would focus on any features causing analysis problems, ongoing changes in the study area, interviews with locals concerning past flood experiences or changes to the area since large past floods, contacting local agencies to obtain information on the area and on any plans for modifications that could affect the Corps analysis, and other items of interest.

Coordination and Communication. Various coordination and information needs must be addressed in the HEMP.

1) PT Needs. The various hydrologic information needs of the interdisciplinary planning team have been briefly described earlier. All hydrologic information needs anticipated should be obtained from the IPT during the reconnaissance process for inclusion in time and cost estimates for the feasibility phase.

2) Sponsor Needs. The sponsor usually has valuable information about the study area. The sponsor may have some capability for obtaining necessary information pertinent to the project or for performing some of the hydrologic engineering necessary for the study, which could be a credit for the sponsor. The cost sharing partner normally has specific views on the type of alternatives he believes are most suitable for the study area. All these possibilities would be reflected in the HEMP.

   An initial HEMP is very useful in dealing with the local sponsor on necessary hydrologic engineering activities and in justifying the hydrologic engineering cost estimate, which the sponsor must cost share. Discussing the necessary hydrologic activities, summarized in a HEMP, with the sponsor is more likely to result in agreement on the effort involved than to simply present the sponsor with a total cost.

3) Feasibility Cost Sharing Agreement. The feasibility cost sharing agreement (FCSA) cannot be negotiated adequately without having the hydrologic engineering work defined in sufficient detail. The hydraulic engineer must be involved in any negotiations concerning hydrologic engineering, or in hydrologic engineering work that the sponsor might perform for the project. The hydraulic engineer must approve the technical value of the sponsor's work before it can accepted as a sponsor credit.

Hydrologic and Topographic Information. The hydraulic engineer must evaluate the available data, as well as estimate what additional data is necessary for conducting the study. Actual climatologic, hydrologic, hydraulic, sediment, water quality and infrastructure data available would be determined, sources and quality of such data evaluated, and any special needs for a limited data collection program determined. Topographic information necessary to develop accurate water surface profile information will require estimation.

Basic Analysis Approaches. The analysis approach must be based on the hydrologic information needs of the IPT, unusual features of the study, the type of alternatives requiring investigation, the significance of the alternatives on the sediment regime, and other considerations. Selection of the appropriate hydrologic model, a single event or a

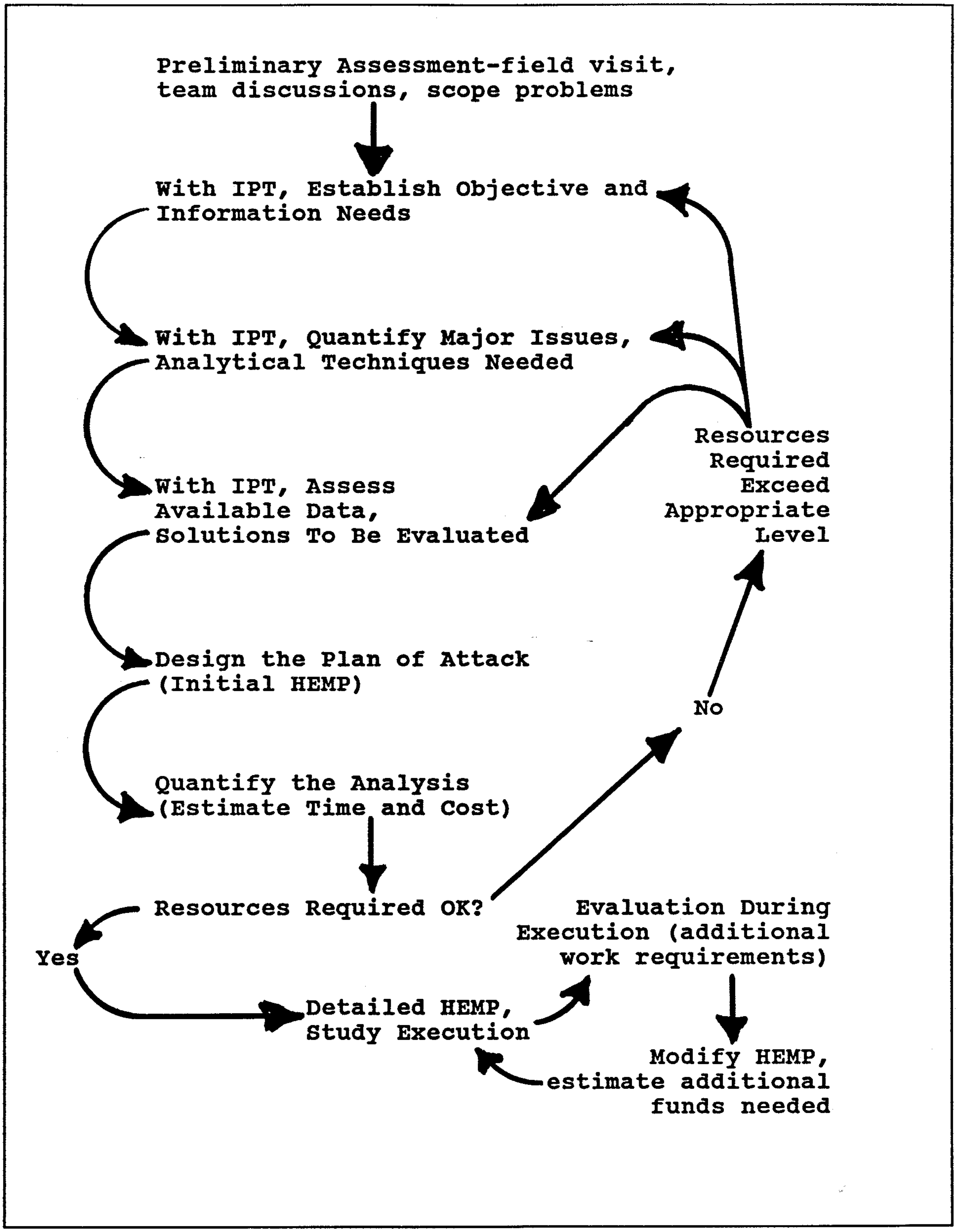


Figure 1
Hydrologic Study Design

continuous model, steady or unsteady flow procedures, qualitative or quantitative sediment analysis must depend on the judgement and skills of the responsible hydraulic engineer. Models and procedures should be selected based on the reduction of uncertainty in the end product. If a sophisticated, high tech model or procedure does not give a significantly improved result and reduced uncertainty, a less sophisticated method is probably appropriate. Selection of new models or procedures could include an allowance for assistance by HEC, WES or other consultants. New models and innovative, unusual procedures should be approved by higher authority at the technical review conference held at the end of the reconnaissance phase, or earlier. Peer review by the appropriate HQUSACE-sponsored committee should also be considered for unusual or complex analyses.

Feasible Alternatives and Number of Iterations. For many projects, the number of alternatives can be reasonably narrowed to three or less for more detailed evaluation in the feasibility phase. For instance, in a local protection project, an upstream reservoir may be quickly eliminated due to high cost, and the alternatives limited to levee only, or levee and channel combinations.

For each alternative or combinations of alternatives, the number of different sizes of the individual component to evaluate should also be kept to a manageable and reasonable number. Agreement should be reached among IPT members, during the HEMP preparation, concerning the number of sizes to be evaluated for each alternative. Three or four sizes for each of two or three alternatives should be adequate for most studies. The cost of evaluating many sizes for each of several different alternatives, or combinations of alternatives, generally cannot be supported by a local sponsor.

Scope the Major Hydrologic Studies. Using a flood reduction study as an example, these major activities might be:

1) Rainfall-Runoff Analysis. Assess calibration data available, number of subareas and routing reaches, type of model, etc.

2) Frequency Analysis. Select procedure for obtaining discharge-frequency relationships (hypothetical floods, period of record, statistical analysis, combinations, etc.), determine locations where discharge-frequency information is needed. Assess risk and uncertainty effort involved.

3) River Hydraulics. Assess type of model, estimate miles of stream and number of sections to be coded, locations where stage-discharge relationships are needed, evaluate risk and uncertainty requirements, etc.

4) Storage Operations. Type of routing method suitable, reservoir analysis needed, unsteady flow problems.

5) With Project Evaluations. Model adjustments needed, method of modeling, risk and uncertainty information.

6) Hydraulic Design. Amount of design detail needed.

7) Sediment Analyses. Qualitative versus quantitative.

8) Appendix Preparation. Also data to be furnished for main report and environmental assessment or EIS.

Initial HEMP Preparation. Using information from the preliminary assessment, identify the major activities, including alternatives to be analyzed and the range of sizes to study. The initial HEMP would be used to estimate man-days for each activity to establish a total hydrologic engineering cost. An example of an initial HEMP for a flood control study is presented in Appendix A.

Time and Schedule Estimates. With the initial HEMP, determine the man-days required for each major technical hydrologic engineering study component (rainfall-runoff analyses, river hydraulics, with project modeling, etc.) and for the complete hydrologic engineering effort. Estimate the man-days necessary for each discipline (hydraulic engineer, technician, supervisor, etc.). Estimate when necessary information must be furnished to (or received from) other IPT members. When duration is less than the initial man-days of activity necessary for completion of the activity, note that additional manpower will be needed. Clearly indicate the number of alternatives to be evaluated and the number of sizes to analyze for each alternative. Determine if special training is necessary for the responsible engineer to effectively perform the study. Include any other factors having a significant impact on required time for the hydrologic engineering analysis, along with any assumptions on which the estimate is based. Include a reasonable contingency allowance.

Funding Estimates. Determine the chargeable rate for each technical discipline used in the hydrologic work. Include all direct and indirect overhead charges for the Engineering Division and for the District. The chargeable rate for District personnel currently averages about 2.8-3.0 times the base salary. For example, if an engineer earned $25/hour base wages, the engineer's time is charged at $70-75/hour to the project. Total the funds for each major activity and for the total hydrologic engineering effort. Forward the estimate to the study manager for approval of hydrologic time and costs. Appendix B gives an example of a simple time and cost estimate.

Resource Evaluation/Negotiation. Where agreement cannot be reached with the study/project manager, or with higher authority, on the required time and funding that the hydraulic engineer believes is necessary, the study objectives, purposes, alternatives to evaluate, etc. must be modified. The effects (and potential dangers) of cutting back or eliminating certain hydrologic engineering activities must be clearly communicated to the project or study manager. The manager must understand what is being lost in terms of analysis quality, decreased comprehensiveness of the hydrologic engineering work, increased uncertainty in the final product, lowered defensibility during technical review, and increased risk of major review comments and significant rework. In no case should the hydraulic engineer agree to do the same work for less funds.

Through an iterative process, come to agreement with all concerned on study objectives, analysis approaches, alternatives to be analyzed, sizes to study, and level of detail obtainable with funding constraints. Prepare written documentation on this agreement and include any problems, difficulties or lack of engineering detail that may result from this reduced effort. Finalize these activities in the HEMP for inclusion in the initial project management plan, or PMP. Reference these changes and agreements in the hydrologic engineering management plan, or in separate documentation.

The IPMP is reviewed and approved by the chief of each technical division. The signature of the Chief of the Engineering Division on the IPMP indicates that the hydraulic engineer agrees to perform these activities for the funding specified. The responsibility then falls on the hydraulic engineer to keep a record of his/her work effort throughout the study to insure the actual time and costs are commensurate with the agreed amount. Additional hydrologic work required by the IPT or sponsor during the feasibility or design phase must result in additional resources being made available by the project or study manager.

COMMON PROBLEMS DURING THE FEASIBILITY PHASE

Certainly not all problems can be foreseen during the outlining of the hydrologic activities necessary during the feasibility phase, and the resulting time and cost estimates. The responsible engineer and/or supervisor should be on the look-out for a number of potentially severe problems that have historically caused difficulty and embarrassment to study participants. Some of these are briefly presented as follows:

<u>Lack of Hydrologic Funds for Study Completion</u>. This unhappy situation has often been the rule rather than the exception and can be the result of:

1) Insufficient hydrologic engineering effort in preparing the time and cost data for the feasibility effort. Doing a good job of estimation is time-consuming and is enjoyed by almost no one. However, it is absolutely necessary, with hydrologic engineering input to the IPMP often requiring several days or more of hydrologic planning effort. If this effort is adequate, the funding should be adequate.

2) Lack of agreement between the study manager and the hydraulic engineer. All parties should be on the same wave length as to study objectives, alternatives, etc.

3) Additional alternatives/iterations are requested to be analyzed in detail during feasibility, without increases in hydrologic funding. The engineer must use the HEMP as a working document to do the work that was contracted for, and to show that additional funds are needed for additional effort.

4) Setting hydrologic budgets by planning or project management with limited or no hydrologic engineering involvement.

5) Not using the correct salary rates, including all overhead charges, for the man-hours estimated. Overhead rates change frequently, so take care to apply the correct total hourly charges. Using less than the actual rate to compute hydrologic study funding is a common failing.

Poor Communication/Coordination. This situation could occur between engineering elements, between planning and hydraulics, between the local sponsor and the District, etc. Weekly to monthly IPT coordination meetings should be held to review progress, overview upcoming work, and confirm milestone dates. While holding these formal meetings is the responsibility of the study manager, hydrologic personnel should also maintain informal communication lines with all members of the IPT to ensure effective use of time and funds.

Deferring Critical Items to Later Reporting Stages. With 50-50 cost sharing, management may wish to defer high cost studies to a later phase. While this might be attractive in feasibility, it is not unusual to see this result in greatly increased construction costs in the detailed design phase (threatening the 20% maximum increase), or even in the project becoming economically unfeasible.

Effect of Reviewers Requirements. Most comments from higher authority are constructive and reasonable, however a reviewer should be aware of what is "nice-to-know" versus comments which are necessary to ensure a safe and functional project. Additional work to satisfy comments is expensive and also cost shared.

Technical Analysis of Complex Problems. Hydrologic costs will be significant when unsteady flow must be addressed, when major sedimentation problems exist, where two-or three dimensional analyses are needed, and for many other complicated situations. Urban interior flood control analyses may be the most common example of a complex hydrologic analysis requiring a carefully prepared estimate of the required work activities and time and funding requirements.

Sponsor Credit for Hydrologic Engineering Work. The tendency for management is to assist the local sponsor in keeping his costs manageable. The hydraulic engineer must insure that any hydrologic or hydraulic effort by the local sponsor is useful and of direct benefit to his/her analysis before accepting the work, and correspondingly reducing the District hydrologic engineering funding.

Expenditures During Non-Working Periods. Funds tend to be spent, even if no work is being performed on the project. The hydraulic engineer needs to carefully monitor his work effort and charge to a project only when study activities are on-going. Re-assigning personnel is another cause of excessive expenditures, due to the start-up costs associated with getting a new member up to speed.

SUMMARY

The IPMP and local cost sharing have greatly changed the Corps' method of doing business, resulting in hydrologic planning being more critical than at any previous time. Better planning and management of technical hydrologic activities is necessary to accomplish the necessary studies for an agreed cost. The use of a hydrologic engineering management plan to scope activities and develop time and cost estimates has become a necessity, rather than an option.

Communication and coordination activities have also greatly increased in importance. Most successful studies result from situations where the study manager stresses communication. He or she chairs frequent meetings of the IPT and utilizes IPT members in the decision-making process; i.e., the manger is part of the circle and not the center of it. In particular, the manager, economist and the hydrologic engineer must work closely together for a successful feasibility report that is produced on time and within budget amounts.

RELATED GUIDANCE

Cochran, Albert L., Memorandum "A", Hydrologic Engineering Associated with Survey Studies, January 1965.

EC 1110-2-268, Engineering and Design for Civil Works Projects, 1 July 1991.

EP 1105-2-15, Planning Programs, 27 January 1982.

EP 1110-2-6005, Hydrologic Engineering Analysis Requirements for Cost-Shared Flood Damage Reduction Studies, (to be published shortly).

EP 1110-2-6007, Hydrologic Engineering Studies Design, (to be published shortly).

EP 1165-2-1, Digest of Water Resources Policies and Authorities, 15 February 1989.

ER 5-7-1(FR), Project Management, 1 March 1991.

ER 15-2-14, Committees on Tidal Hydraulics, Channel Stabilization, Water Quality, and Hydrology, 1 January 1989.

ER 1105-2-100, Guidance for Conducting Civil Works Planning Studies, December 1990.

ER 1110-2-1460, Hydrologic Engineering Management, 7 July 1989.

ER 1110-2-1150, Engineering after Feasibility Studies, 15 November 1984.

ETL 1110-2-230, Hydrologic and Hydraulic Engineering for Survey Investigations, 15 May 1978.

APPENDIX A

INITIAL HYDROLOGIC ENGINEERING MANAGEMENT PLAN FOR A FEASIBILITY STUDY

Scenario. *The study objective is the development of a flood protection plan for a community experiencing periodic flooding from a stream draining a few hundred square miles. The reconnaissance report was based primarily on flood insurance study data and a simplified hydrologic engineering analysis. The recon has made a preliminary determination that a levee project is economically feasible. The community is willing to be the cost sharing local sponsor and would like a minimum certifiable level of protection of a 100-year recurrence interval. A gage with 15 years of discharge data is available at the site, with additional, short record gages located elsewhere in the watershed.*

The feasibility phase will establish existing and future without project conditions. After discussions with the IPT and local sponsor, it was decided that three heights of levee (alone) will be studied, along with six combinations of levee height and channel improvements to develop the economic optimum plan. A total of nine alternatives will be evaluated. As all the levee alternatives are along a similar alignment, a detailed interior flood analysis will be evaluated for only the NED levee or levee and channel plan. The hydraulic engineer must prepare an initial HEMP for the hydrologic engineering cost estimate for the feasibility phase.

This sample initial HEMP represents what one might develop at the end of the recon phase for a time and cost estimate for use in the IPMP.

I. Preliminary Investigations/Initial Preparation

Finalize study objectives, confer with IPT on the hydrologic engineering information requirements and study constraints, development information needs, field reconnaissance, prepare survey data request, prepare detailed HEMP.

II. Development Of Basin Model (HEC-1)

1. Calibration of Runoff Parameters--Using basin gage data, develop unit hydrograph and loss rate parameters for use in the study.

2. Delineation of Subareas--Subdivide study watershed based on the need for discharge-frequency information at specific locations: major tributaries, damage index points, routing reaches, project sites, etc.

3. Subarea Rainfall-Runoff Analysis of Historic Events--Develop historic storm events, and subarea loss rate and unit hydrograph data for ungaged areas.

4. Channel Routing Characteristics--from part III.

5. Assemble, debug HEC-1 model.

III. Hydraulic Studies

1. Prepare Water Surface Profile Data--Code HEC-2 model of study reach, after receipt of surveys. Estimate "n" values, section locations, bridge routines applicable, effective flow areas. Debug model.

2. Calibrate HEC-2 model to gage data and highwater marks from recent floods.

3. Develop storage-outflow relationships and flood wave travel time, by routing reach, for information required in paragraph II 4 above.

IV. Calibration Of Models To Historic Events

Calibration of HEC-1 and -2 models to recorded events and highwater marks. Preliminary selection of hydrologic and hydraulic model parameters for hypothetical flood event analysis.

V. Frequency Analysis For Existing Land Use Conditions

1. Perform statistical analysis of gaged data for peak discharge-frequency relationship. Also estimate discharge-frequency relationships through available/applicable regression equations at key locations, to use in later comparisons.

2. Hypothetical Storms (HEC-1)--Develop hypothetical frequency storm data from NOAA HYDRO 35, NWS TP40 and 49. Develop the Standard Project Storm. Develop rainfall pattern for each storm, including precipitation depth-area adjustments. Develop corresponding hydrograph for each hypothetical event throughout the basin using the calibrated hydrologic model of part IV.

3. If judged appropriate, further calibrate model to reproduce the peak discharge calculated from the statistical analysis at the gage site. Emphasize the 2-year through the 10-year event, since the data record is short. Make adjustments to loss rates and unit hydrograph coefficients for rarer events, as judged reasonable. Compare results to statistical and regression-derived peak discharge frequency relationships; further adjust coefficients as considered reasonable.

4. Using the results of V1-3, adopt a discharge-frequency relationship at each needed location. Develop confidence limits and probability distribution for use in risk/uncertainty analyses. An equivalent 20-30 year record length should be obtainable.

5. Determine corresponding water surface profiles and inundated areas for selected frequencies at required locations. Furnish data to planning and economics.

6. Adopt stage-discharge relationship at each required location for damage computations. At the one gage site with 15 years of data, determine deviations about the adopted stage-discharge relationship. Further evaluate through sensitivity studies. Develop a probability distribution for risk and uncertainty analysis (a minimum standard deviation of about 0.5 foot is expected).

VI. Future Without Project Analysis

Determine future stage-discharge relationships, based on future watershed changes affecting the hydraulics. If necessary, adjust discharge-frequency and stage-discharge risk/uncertainty relationships. Furnish data to economics.

VII. Levee Alternative Evaluations

For the preliminary levee alignment, develop revised stage-frequency relationships for each of the three different levee heights. If judged necessary, determine revised stage-discharge risk/uncertainty relationship. Roughly size a "minimum facility" interior flood control system for each. With the economist, perform risk and uncertainty studies to establish the claimable level of protection (risk-based) and average annual benefits resulting for each.

VIII. Levee and Channel Alternative Evaluation.

1. For two sizes of channel, reestablish stage-frequency relationships for each of three levee sizes (6 alternatives). Increase stage-discharge risk/uncertainty relationship, allowing for uncertainty in channel geometry at time of important floods. Evaluate the need to adjust the discharge-frequency risk/uncertainty relationship. Roughly size a "minimum facility" interior system for each alternative, if necessary. With the economist, perform a risk-based analysis to determine project benefits and claimable level of protection for each alternative. Perform qualitative sediment analyses for channel modifications to roughly determine dredging frequency for channel maintenance. After economic analysis to tentatively establish the NED plan (levee height) from among the nine alternatives, design top of levee grade for controlled overtopping.

2. If a channel modification is included in the NED plan, perform sensitivity tests to determine the importance of channel maintenance assumptions and costs on NED plan. If a more conservative sedimentation analysis results in significant cost increases, possibly invalidating the NED plan, additional sediment analyses will be required in feasibility. Hydrologic engineering work for a quantitative sediment analysis is not included in this estimate. Adjust final levee grade for any sediment effects.

3. As necessary, furnish hydrologic information, as it becomes available, to other IPT members: stage-duration and frequency to environmental, data for Environmental Assessment Report, etc.

4. Non-structural analysis of emergency procedures in event of levee overtopping--evacuation and flood warning

IX. Residual flooding and interior flood control

Establish residual flooding for remaining flood damages with the NED project. Evaluate higher levels of interior flooding protection compared to the "minimum facility".

1. Using Interior Flood Hydrology Program, evaluate two gravity drains larger than the "minimum facility" at each of the three gravity drain locations.

2. Evaluate interior excavated storage at the one site where it is currently thought feasible.

3. Evaluate three capacities of pumping plants at each of two sites.

4. Evaluate interior ditch improvements for the two main ditches.

Forward data to economist, cost engineer for each increment. Supply hydrologic data for wetland determination and mitigation, as necessary.

X. Hydraulic Studies

Some of the design work will have been already incorporated in the above activities for paragraphs XIII and XI.

1. Levees--levee design profile, controlled overtopping design, gravity drain design for "minimum facility", etc.

2. Channels--channel geometry, bridge modifications, scour protection, channel cleanout requirements, channel and bridge transition design, etc.

3. Drains--size, slope, material, inlet/outlet, operation procedures, etc.

4. Pumping--capacities, start-stop pump elevations, sump design, outlet design, scour protection, operating floor elevations, etc.

XI. Hydrologic Engineering Reporting Requirements

1. Project Management Plan--Estimate major hydrologic engineering activities in PED, prepare initial HEMP for PED work, prepare time and cost for hydrologic engineering, activity schedule.

2. Hydrologic Engineering Appendix to the Feasibility Report--Using the detailed HEMP as appropriate, outline and write the text, prepare tables and figures

3. Environmental Assessment Report--Provide data to environmental section. Supply text, figures, plates, as needed.

APPENDIX B

SAMPLE H&H TIME AND COST ESTIMATE

While not prepared specifically for an IPMP, this time and cost estimate is representative of the hydrologic response necessary. It addresses the method of analysis, the main assumptions on which the estimate is based, the objective of the study, how the work is be accomplished, and the rough breakdown of the main activities, yielding the time and cost estimate. This estimate was prepared for an actual study, and required about 20 hours of hydrologic planning--8 in the field and about 12 to develop the initial HEMP for the estimate. The time and costs were approved by HQUSACE Planning personnel, who provided funds to initiate the work in late July.

CELMS-ED-HE 13 Apr 92

MEMORANDUM FOR CELMS-PD-F

SUBJECT: Time and Cost Estimate for H&H Studies for Nashville, Illinois

1. In response to a verbal request from PD-F, the undersigned made a field reconnaissance of streams affecting the community of Nashville, Illinois and met with the City Engineer and Chief of Maintenance. The attached time and cost estimate are the result of discussions on the area flood problems with these personnel and problems observed through the site visit. The streams are Nashville Creek, two tributaries (West Branch and St. Ann Court), and two small tributaries of West Branch. The 100-year recurrence interval flood is to be determined and mapped for each stream.

2. Nashville Creek will require an HEC-1 model, primarily because of the water supply lake located on a tributary near the city limits. The effects of the lake on downstream peak discharges and timing can only be addressed by routing through lake storage. The HEC-1 model would probably consist of about 8-9 subareas and 4-5 routing reaches. A 15-30-minute computation interval and a 12-24 hour design storm duration should be sufficient to model watershed runoff. The SLD, Illinois USGS, and nationwide urban regression equations for peak discharge will be used to estimate a 100-year return interval peak discharge at selected locations along all streams. Peak discharges for Upper St. Ann Court Trib, West Branch, and its tributaries will be developed using regression equations only.

3. HEC-2 models will be developed for all five streams. The HEC-2 models would cover about four miles of Nashville Creek, about 3/4 mile of St. Ann Court Trib, about two miles of West Branch, and about one mile total for the remaining two tributaries. About 15 bridges and culverts are within the reaches to be modeled. An estimated 125 sections will be coded into HEC-2 models of the five streams. Only a 100-year return interval flood profile will be developed for the five streams, although Nashville Creek runoff will be calibrated to known high water marks, provided sufficient hydrologic/hydraulic information can be obtained from recent floods.

4. The estimate is shown on Table 1, attached. The study would require about 10 man-weeks for a GS-12 engineer and about 12 party-days of survey time. Total costs are estimated as $43,500.

GARY R. DYHOUSE, P.E.
Chief, Hydrologic Engineering Section

CF: ED-HG (w/Incl)

Table 1

Time and Cost Estimate for Nashville Creek and Tributaries, Illinois

Activity Description	Time (hrs)
Review data, field trip, survey request, Illinois State Highway Department information request, prepare detailed study work plan	40
Develop sub-watershed schematic, determine drainage areas, lengths, slopes, soil type, land use, etc.	32
Develop subbasin loss rates, unit hydrographs, base flow, area-elevation-storage relationships, Muskingum parameters, peak discharges for all areas using regression equations	32
Plot surveyed cross sections and channel profiles, estimate reach "n" values, bridge input data (24 hrs Hydrologic Technician)	56
Code HEC-2 models, run and debug	100
Develop area-elevation-storage-outflow relationship for Nashville Lake, code HEC-1 model of reservoir and watershed, operate, debug, compare with dam safety report information, adjust as necessary	24
Develop 100-year design storm and calibration storms	28
Code HEC-1 model of Nashville Creek, run and debug	24
Develop flows and profiles for flood of record using HEC-1 and-2, adjust as necessary	12
HEC-2 production runs for 100-year event, all five streams	16
Review and finalize profiles	8
Prepare plates and report information for PD-F (12 hrs for Hydrologic Technician)	24
Prepare hydrologic methodology report	24
Allowance for contingencies	24
Supervisory allowance (GM-13 supervisor)	16
Travel, duplicating, perdiem and other miscellaneous costs	$500.00
Survey charges (12 party-days---3 man party, with per diem) ED-HG hired labor @ 15%	

Total Costs

GS-12 Hydraulic Engineer (408 hrs at $70/hour)	$28,560.00
GS-10 Hydrologic Technician (36 hrs at $45/hour)	1,620.00
GM-13 Supv. Hydr. Engineer (16 hrs at $75/hour)	1,200.00
Miscellaneous charges	500.00
Survey costs (field work)	10,080.00
ED-HG hired labor @ 15% of field charges	1,512.00
TOTAL COSTS	**$43,472.00**
	Say $43,500.00

USING IPMP'S AS A LIVING DOCUMENT
THE MANAGER'S VIEWPOINT

by

John W. Rushing, P.E. and James F. Robinson, P.E.[1]

INTRODUCTION

The Initial Project Management Plan (IPMP) is the document developed and used by the study team to ensure accomplishment of the feasibility study as scheduled and within the estimated cost. The purpose of the IPMP is to plan, define, and control the development and delivery of the products from completion of the reconnaissance studies through completion of the feasibility study.

DEVELOPMENT OF THE IPMP

The IPMP is developed by the Planning Technical Manager (TM) in coordination with the Project Manager (PM), other TM's and the partner. It is important to note the IPMP is the first document developed and agreed to by a team associated with the study effort. The agreed to IPMP is appended to the Feasibility Cost Sharing Agreement (FCSA) for the feasibility study. It is a "living document" that must be adjusted for evolving requirements and to react to knowledge gained as the study progresses.

What's Included? The IPMP will include a baseline estimate of total study costs, including a breakout of all non-Federal costs and activities to be performed by the partner. The IPMP will also include a work breakdown structure for the study phase, compiled into a network which can be used as a basis for assigning tasks within the Corps and to the partner, as well as for establishing the value of in-kind services from the partner. The IPMP must include a mechanism which allows the PM to measure the progress and performance of all study efforts. In addition, the IPMP must specifically address the following areas.

1) Roles of the Corps of Engineers and the partner during the planning, land acquisition, engineering design and construction phases of a project.

2) Rights and obligations of both parties during the planning, land acquisition, engineering design, and construction phases of a project.

3) Level of participation of both parties during the planning, land acquisition, engineering design and construction phases of the project.

---

[1]Director, Programs and Project Management, and Assistant Director, Programs and Project Management, U.S. Army Corps of Engineers, South Atlantic Division

4) Responsibilities of both parties during the planning, land acquisition, engineering design, and construction phases of the project.

Who's Involved? While the Planning TM has the responsibility to prepare the IPMP, it is critical that the TM, PM and partner play an active role in its development. This is necessary to insure complete understanding of the roles/responsibilities of all parties, to minimize to the maximum extent possible changes during the conduct of the feasibility study, and to establish an early partnership for the effort. All involved parties must utilize the IPMP in performing their work and recognize the need for it to be a living document subject to change due to unexpected conditions. More importantly, they must recognize the potential impact changes may have not only to how they or others accomplish their work, but the long term impacts on construction and operation of the project.

Coordination. Proper coordination of the IPMP is essential. Early coordination of the draft IPMP with the division can eliminate confusion. Oftentimes, after coordination with the sponsor, the division or HQUSACE will make major changes in the IPMP. To reduce this confusion with the sponsor, division input should be obtained prior to final coordination with the sponsor.

RELATIONSHIP OF IPMP TO PROJECT DEVELOPMENT

The IPMP is in essence the foundation for the execution of the feasibility study, detailed design activities and eventual construction of the project. If properly prepared and updated, it will be an excellent tool for all participants in the evolution of the project. The importance of the IPMP may be demonstrated through the use of Figure 1.

As shown, all participants provide input into the reconnaissance phase. This input consists of but is not limited to furnishing existing data, preparing and reviewing alternative plans, analyzing potential data requirements, developing preliminary cost estimates and benefits and, more importantly, participating in Technical Review Conferences (TRC) and the Reconnaissance Review Conference (RRC) and developing the effort and budget required for the feasibility phase and IPMP. Oftentimes, we have a tendency to use this portion of our study process to develop and train less experienced team members. While this approach is commendable, it needs to be recognized that experienced personnel should play a major role at this stage, particularly since both time and data are limiting factors. Thus, it is extremely important that senior staff be involved in development of the IPMP to ensure to the extent possible that proper data will be obtained and analyses done during the feasibility study. Senior staff should also actively participate in the RRC. Decisions made during the RRC or as a result of the RRC may have a definite impact on not only the feasibility study, but the budget cycle for the total project. This study/project schedule strawman (Figure 2) will help illustrate this impact.

USE OF THE IPMP

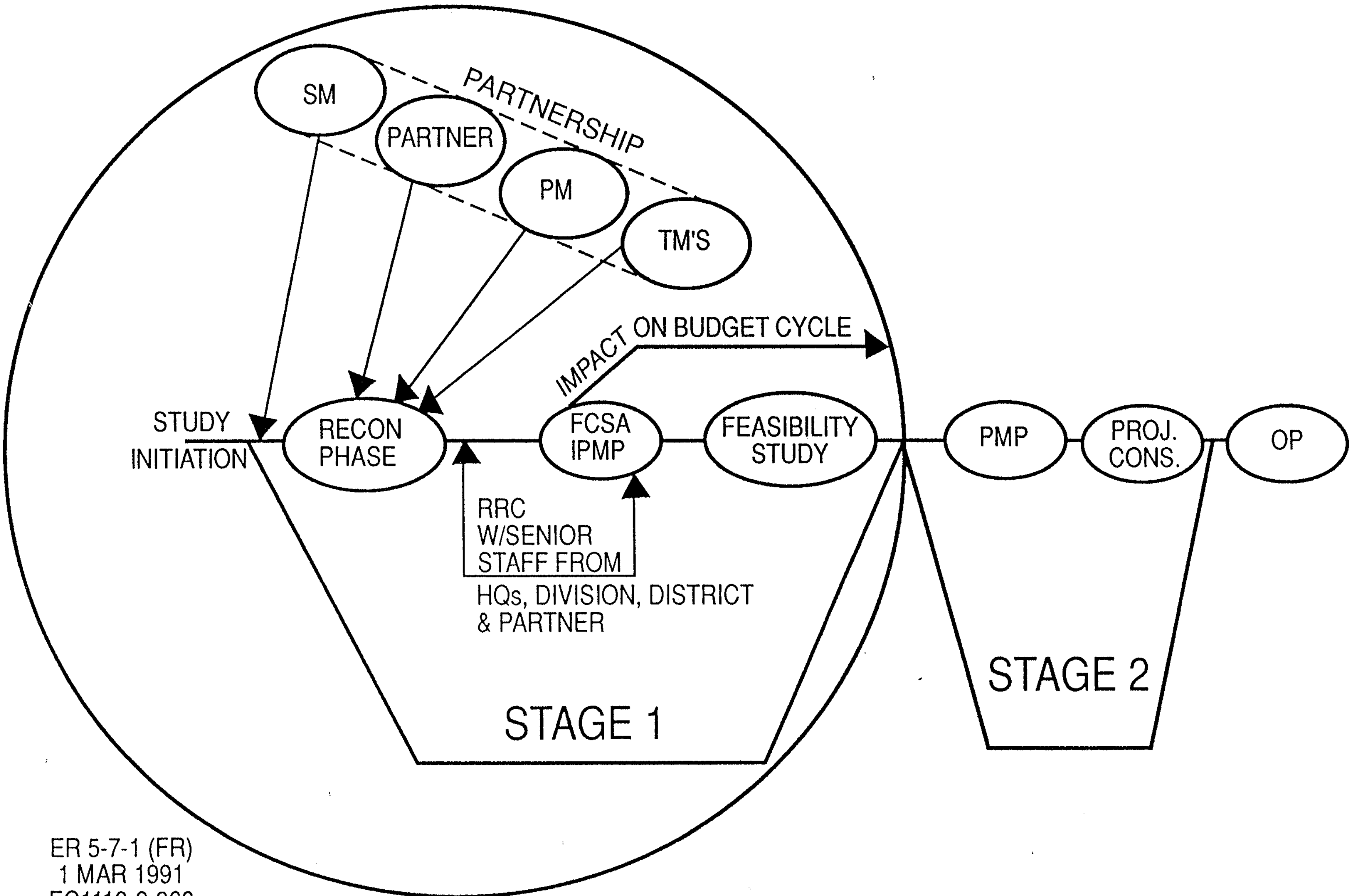
A thorough understanding of what the IPMP is, how it is developed and by whom is necessary to properly utilize it during project evolution. As noted earlier, the IPMP will be used by the PM, TM's and the partner to ensure that the work required to be performed in the feasibility phase has been carefully developed and considered. This does not mean that changes won't occur. In fact, experience has shown that evaluations during early stages of the feasibility study could result in modifications to the level of detail of study efforts and field investigations to be accomplished in later phases of feasibility. This could require changes to the IPMP previously prepared and agreed to by the team. Examples of possible changes may include: (a) physical model studies or vessel simulation studies needed to ensure feasibility of the selected plan (not included earlier in FCSA & IPMP); and (b) additional geotechnical data needed to support the project design and feasibility cost estimate. As a reminder, these types of changes can be limited if senior personnel are involved early in the study process.

How do we go about making necessary changes? We noted earlier that the IPMP was developed by the Planning TM in coordination with the PM, other TM's and the partner. Changes to the IPMP may be made in conjunction with the partner and TM's but must be approved by the PM. (Why? Remember, PM is responsible for schedule and cost.) Significant changes may require a formal change request and modification of the FCSA. The actual procedure to be utilized in dealing with potential changes should be developed and agreed to by the team during preparation of the IPMP. It may be appropriate to include the procedure in the FCSA, the IPMP or both.

CONCLUSIONS

Senior Staff Involvement
Teamwork
Partnership
Communicate

FIGURE 1



ER 5-7-1 (FR)
1 MAR 1991
EC1110-2-268
1 JULY 1991

STUDY/PROJECT SCHEDULE STRAWMAN

STUDY RESOLUTION		BY-10
BUDGET FOR RECON	JUN	BY-10
INITIATE RECON	OCT	BY-8
RRC	OCT	BY-7
FCSA/IPMP	MAR	BY-7
INITIATE FEAS STUDY	APR	BY-7
FRC	FEB	BY-3
DE PUBLIC NOTICE	SEP	BY-3
INITIATE PED	OCT	BY-2
BERH MEETING	FEB	BY-2
ASA(CW) APPROVAL/EIS FILED	JUN	BY-2
COMPLETE PED	SEP	BY-1
CONSTRUCTION NEW START	OCT	BY

THE BY SHOULD BE AN ODD NUMBER TO FIT AUTHORIZATION CYCLE.
EXAMPLE: BY93 = WRDA 92.

FIGURE 2

TROUBLE SHOOTING WITH A MANAGEMENT PLAN

by

Lauren Renning, PE[1]

INTRODUCTION

The dictionary tells us that a trouble shooter is "an expert in discovering and eliminating the cause of trouble in an operation ..." such as planning, designing and constructing (development) of a water resources project. The cause of trouble is the trouble maker. Trouble makers familiar to project development include: lack of data, design criteria changes, design requirement changes, different starting dates, reduced funds, and reduced resources.

A water resources project is planned, designed and brought through construction by a study/project management team that consists of the technical experts and the project manager. Each team member can be a trouble shooter, at any time, in addition to serving the project through their field of technical expertise.

The team is charged with the responsibility for "delivering a quality project to the customer on time and within budget", as first stated in 1987 by then Assistant Secretary of the Army for Civil Works Mr. Bob Page. Does the Corps do this? Occasionally. But the Corps can improve its track record by improving team members' ability to find and eliminate trouble, throughout the life cycle of a project. Trouble shooting saves the study/project time and money, as well as reduces frustration and aggravation to team members. They can feel that they have more control over their part of project development.

The trouble shooting effectiveness of a team member can be greatly enhanced with a few simple tools that consist of contingencies, task-to-task relationships and a change management plan. These should be included in the management plan, which is used by the team leader and the technical experts to carry out the study/project.

A MANAGEMENT PLAN OVERVIEW

What is it? Project management plans in the Corps come in two flavors: Initial Project Management Plans (IPMP'S) for managing feasibility studies and Project Management Plans (PMP's) for managing project design and construction. [2]

1) A management plan literally is a binder containing various "tools" used principally by the project manager to manage the study/project. It is a "living document" that evolves along with project development through its life cycle.

---

[1] Senior Project Manager, Sacramento District, U.S. Army Corps of Engineers

[2] This paper will use the term management plans to represent both "study" and "project" management plans, as termed by the Corps.

2) The binder contains the "structure"[3] and the "strategy" of how the project will be managed. Limited technical information is included in the form of project description and tasks. One would refer to a feasibility report, design memorandum, plans and specifications or the like for detailed technical information on a project, not a management plan.

3) The "structure" of a management plan is the framework that shows how project development will be carried out. It ideally is developed before work on the project is begun, and updated throughout the project life cycle. Often, the structure is updated to reflect successful results of troubleshooting. One can see the structure by looking in the management plan at the network of tasks and milestones scheduled through time, task inter-relationships, the matrix assigning resource responsibility for each task (Resource Assignment Matrix (RAM)), the scopes of work for each task, and the budgets and contingencies.

4) The "strategy" of a management plan also is developed before work is begun and updated throughout the life cycle. Strategy is not how to do tasks. That is spelled out in the scopes of work. Rather, strategy is how to conduct the study, or procedure. It includes a change management plan, a reporting plan, quality management and progress measurement plans, among others. It guides the process of project management.

Dynamics of the Management Plan. The contents of a management plan only partially describe the aspects of a plan. In addition to contents, the "dynamics" of a management plan include:

1) Designed by the team members including the local sponsor(s), with the leadership of the project manager.

2) Signed off by all of the District chiefs and the sponsor that they agree to it.

3) Updated periodically, using established reports to the extent possible.

4) Distributed to all team members for use.

Key pieces of the structure focused on in this paper are the contingencies and inter-task relationships and the key strategy discussed is the change management plan. These are tools that can be used to find and eliminate situations ranging from nuisances to catastrophes.

---

[3] "Structure" is a term used by the author; it is not found in Corps of Engineers regulations.

DESIGN TROUBLESHOOTING TOOLS INTO THE MANAGEMENT PLAN

Management plans are developed by the team members, with each member contributing from his or her area of expertise and the project manager providing integration of the pieces. The three troubleshooting tools discussed herein already are requirements of a management plan. With attention paid to the troubleshooting value of these tools, team members can start troubleshooting as they develop the management plan, before actual work on the project is begun.

Inter-task relationships. When laying out the structure of a project network, the tasks and their inter-relationships are identified. With attention focused on troubleshooting while laying out inter-task relationships, potential trouble makers such as lack of data, changes in design criteria and design requirements, and starting dates can be ferreted out before work is begun. This is the first step in troubleshooting, identifying the troublemaker.

Inter-task relationships usually are established on a task by task basis; they are best determined by focusing on one task at a time. For example, focus on the task of developing a flood plain. The inter-task relationships are established by answering the questions, "Which tasks have to come before flood plains and which tasks will follow." To enhance troubleshooting, both the technical team member and the project manager also should look at the inter-task relationships as representing input and output. Ask what input (data, reports, criteria etc.) will be needed before flood plain work can begin, what output will be produced by flood plain work and who will use it? The answers will not necessarily be reflected in the network itself, depending on the computer program and level of detail the project manager uses. However, a list of the input, unknowns, uncertainties and unavailable data should be included in the flood plain scope of work, in this example. Because one person's output is another person's input, the scope of work also should include the expected output for the task. Spelling out the input requirements before beginning work on a task typically troubleshoots future problems. Scopes of work with this information in them also are valuable tools for troubleshooting during project development. Input information also forms the basis for contingencies.

Contingencies. Another tool that team members can use to troubleshoot both before a project is started and during project development is contingencies. Troubleshooting with contingencies can help with problems of reduced funding and manpower and schedule changes.

If scopes of work for each major task include input requirements, contingencies naturally should follow. Contingencies are estimated for both funds and time (float) requirements. A scope of work for a task should include a statement of the unknowns, uncertainties and the assumptions, based on knowledge of the input requirements for a task.

1) Unknowns and uncertainties address what is known, unknown and uncertain about required task data and criteria input. A team member should consider such things as data requirements, procedures to conduct work, design criteria, design requirements, resources, and funds.

2) Assumptions would stem from the unknowns and uncertainties to allow the work to proceed.

3) Contingencies in time and money should be included in the budget and schedule to reflect the assumptions and unknowns spelled out in the management plan.

For example, in the case of developing flood plains, unknowns and corresponding assumptions can be found in infiltration, hydrological, topographical, and runoff data. Depending on the sensitivity of the unknown/uncertain data and the probability of the information becoming available, a contingency of cost and time can be estimated in case additional work has to be done on flood plains.

Change Management Strategy. When developing a management plan, include a Change Management Plan or strategy. Once we spot the troublemaker through examining inter-task relationships or contingencies, or other means, we are left with the task of eliminating the trouble. We have to communicate our findings so a fix can be implemented. This communication and fixing is part of the change control plan. It is a management, communication and documentation and control plan. A change management plan should include the following:

1) How to report a change, what form to use and/or what format, documentation. How to fill out the necessary forms. When is verbal (phone) communication acceptable and when is written appropriate.

2) The review process and approval levels.

3) Description of sensitivity and risk analysis and threshold sensitivities for changes to the study plan itself as well as to the project.

4) How to update the management plan.

USING TROUBLESHOOTING TOOLS

Once a study or project is under way, trouble starts and troubleshooting should go into effect. It is initiated by any team member at any time. They can use the inter-task relationships and contingencies designed into the structure of the management plan to identify trouble and the change management plan to eliminate it.

Inter-task Relationships and Contingencies. Trouble with input data, design criteria, and design requirements as well as start dates can be identified before a task is started by reviewing the information on input and contingencies that is written into the scopes of work. This is particularly true if some time has passed since a scope of work was written. Both the project manager and the technical staff can go over the input list, unknowns, uncertainties and assumptions in advance and determine if all of the input will be available to start work and the assumptions still are valid. This exercise typically uncovers sources of data that are lagging in time, not being developed, incomplete or being developed in an incompatible manner. Also, the basis for task contingencies may have changed drastically since the study/project first started. These types of reviews can be done with a phone call, at a team meeting or by memo. If the network tasks are grouped by major milestones, several tasks can be reviewed at once at a milestone date.

For example, the task "Update Hydrology" may required input to start the task that includes 1) current criteria on developing flood hydrographs, 2) design requirements for development of flood frequencies and 3) data such as topography, vegetation cover and stream gage and precipitation records. A week before the task starts the person responsible for the task reviews the scope of work and finds out that the stream gages were washed five years ago. This gives the Project Manager and the technical staff time to make decisions on how to proceed, rather than finding out after the task is well under way and money is spent.

Using the above example, the same information in the scope of work can be used by the people working on the preceding tasks. In other words, if a preceding task is having trouble producing their output, such as topography, the Project Manager can troubleshoot by looking at the scopes of work of the relevant succeeding tasks. Again, decisions can be made to try and eliminate the trouble before the preceding task is finished.

Change Management Plan. The contingencies and task relationships help to identify trouble. The Change Management Plan can help to eliminate trouble and update the management plan. Once a change of some kind is identified, the Change Management Plan should tell you what to do. Changes can be to the project (project cost, location, financing) as well as to the management plan itself. Some of the steps one may take in eliminating trouble include:

1) Determine if the task is on the critical path and if the schedule is sensitive to the change. Look at the effect on major milestones.

2) Determine the sensitivity to change of the project cost estimate, benefits, cost allocation, cost sharing, financing and benefit to cost ratio. Determine if the Section 902 limit will be exceeded.

3) Determine all other tasks affected by the change.

4) Consider the risks of alternative courses of action.

5) Determine if the change can be made within the funding contingency and float.

6) Fill out a change request form for documentation and send it through the system for review and approval. Documentation may include results from the determinations discussed above.

7) Update the IPMP/PMP if necessary. Send out substitute pages.

CONCLUSION

Each Project Manager has to decide about the trade off of spending the time and money, up front, to define such things as the contingencies and the change management plan, before a study or project begins, versus troubleshooting on the fly. Once good scopes of work are written for a study or project, usually they can be modified fairly easily for another study or project, with the benefit of experience; i.e. designing a spillway is designing a spillway. This is particularly true of the project manager is using project management computer programs to assist her. Troubleshooting tools already can be found in most management plans. The real decision is whether to use them or not.

IPMP'S - MATRIX ANALYSIS FOR ALTERNATIVES SELECTION

by

Daniel R. Harvey, P.E.[1]

INTRODUCTION

The past several years have seen a considerable change in the way the Corps performs its feasibility studies and our relationship with individual entities involved in this study process. With the advent of local cost sharing, and other cost containment and reduction efforts, a new and closer relationship between the federal government, technical and project management elements, and the partner/customer (project sponsor) has developed to keep costs and schedules under control and within realistic and competitive limits while trying to ensure that a quality product is produced.

IPMP development, however, can be more involved, perplexing, and complicated than it might seem, at least from the technical evaluation side. This is partly because along with the IPMP process also came the need to perform detailed analysis and design of the selected project plan (NED - National Economic Development plan) at an earlier stage than in the old GDM (General Design Memorandum). This meant that considerable thought had to be given in the reconnaissance stage to the amount of work necessary in feasibility to evaluate alternatives and the final project plan even though it is not always recognizable at the time the IPMP is being prepared what the final plan would be. The problem is exacerbated if there are a large number of good alternatives to be examined at the feasibility stage, any one of which could require significant and costly technical evaluation if studied in any detail.

The situation can be handled to some extent by including contingencies in the IPMP if a reasonable potential exists for additional studies (e.g. physical model studies) if certain alternatives are selected, or by a SACCR (Schedule and Cost Change Request) if a problem arises that was completely unanticipated after studies have commenced (e.g. unforeseen fishery and environmental studies). To a great degree, the best approach to reducing the potential for being overwhelmed by a large number of alternatives appears to be a careful up front review and analysis of alternatives prior to feasibility and early and continued coordination with the sponsor on the potential for changes to the IPMP and the cost agreement if certain outcomes occur.

STUDY PROBLEM

This paper discusses how Seattle District used a simple but effective matrix evaluation method to help minimize the uncertainty in estimating study costs, and to reduce the need for contingencies and other hedging devices in preparing the IPMP for the Lake Washington Ship Canal Water Conservation feasibility study. The study involved the potential for analyzing in the feasibility phase a large number of very good but analytically complicated

---

[1]Chief, Hydrology Section, Seattle District, U.S. Army Corps of Engineers

and/or costly water savings alternatives for the Corps Hiram Chittenden locks on the Lake Washington Ship Canal.

STUDY PURPOSE

The Lake Washington Ship Canal and Hiram Chittenden locks are located within metropolitan Seattle, Washington (figure 1) and were completed by the Corps in 1917. The locks provide for the passage of commercial and recreation boat traffic between the freshwater of Lake Washington and the saltwater of Puget Sound. Roughly fifty percent of the water used to operate the locks during the summer (in addition to storage in Lake Washington) comes from the Cedar river which also provides 66 percent of the main municipal and industrial (M&I) water source for the City of Seattle. The Cedar river also supports the largest sockeye salmon runs in the contiguous 48 states.

The City of Seattle Water Department (SWD) when planning its M&I operations must consider both the Corps superior right to the natural flow in the Cedar river and the State of Washington Department of Ecology's instream flows requirements for fisheries on the Cedar river, both of which are below the City's storage reservoir and M&I diversion structure. Because M&I water supply has become such a critical concern in the Seattle area and because SWD's options for new sources of supply are limited at this time, a reconnaissance study was sponsored by the SWD to look at water usage and savings at the Hiram Chittenden locks. The ultimate purpose of the study was to determine if a reduction in lock water usage might be transferred to an equivalent reduction in Cedar river flows with the savings stored or diverted by SWD for M&I water supply.

As a result of publicity received during the droughts of 1987 and 1992, a multitude of water savings ideas for the locks were received from a variety of public and private sources (table I). The reconnaissance study focused on two of these alternatives that appeared to be technically workable, and easily/quickly lent themselves to a cursory analysis to determine their economic viability. This left a considerable number of alternatives to be evaluated during feasibility studies, one or more of which might then be selected for detailed final design studies. The potential to under or over estimate the cost of the feasibility studies was substantial as many of the alternatives required extensive technical analysis even if only performed at a reconnaissance level.

Table 1

LWSC OPERATIONAL/STRUCTURAL ALTERNATIVE
FOR FRESHWATER USE REDUCTION

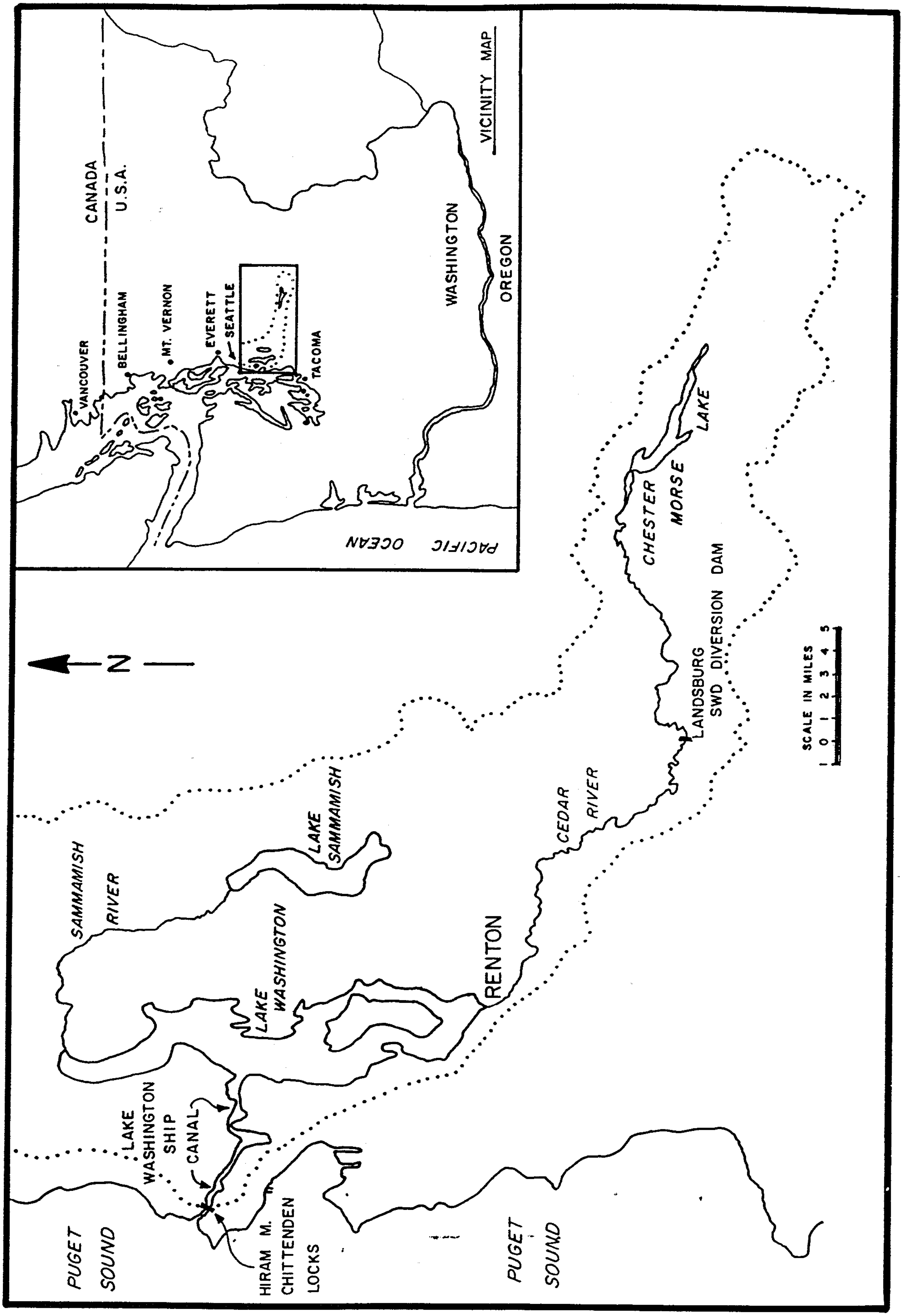
1. New barrier/salt drain further up canal at narrow spot.
2. Make saltwater return system work per design memorandum No. 3, Aug. 1972.
3. Boat lift.
4. Toll.
5. Set lockage times better, especially for commercial.
6. Enlarge small locks - lengthwise.
7. Add balloon or diaphragm to large lock to reduce volume.
8. Raise summer lake level (above 22 feet) and pay damages.
9. Lower minimum authorized lake level.
10. Pump lock water into storage tanks.
11. Pump lock water back into lake.
12. Air curtains in conjunction with improved salt water drain.
13. Cap/cover over saltwater drain to limit inflow of lake water.
14. Better management of saltwater drain, i.e., continuous opening and closing of the valve to improve efficiency of the drain.
15. Use metro effluent for locks or add to Lake Washington.
16. Transfer of water between large and small locks.
17. Pump saltwater in lock to overflow fresh into forebay.

EVALUATION SCHEME

To help reduce the expenditure of time and funds required to study all the alternatives in feasibility, a qualitative/subjective selection mechanism was developed by the study manager (Derek Chow, Memorandum dated 3 April 1992) to help the study team quickly select the most promising water savings options to be evaluated in the feasibility phase. The group assembled to evaluate the alternatives was structured to include the in-house experts from each of the major disciplines that would be involved in the feasibility analysis. The process involved evaluating in a matrix (table 2) all previously identified alternatives against a set of performance criterion and applying an importance rating. The results were then grouped into three action categories from no-, to some-, to full study action required in feasibility.

CRITERIA

The criterion used to evaluate each alternative were developed considering all significant/relevant elements of the study. A brief annotation of each elements meaning helped the team to focus on the tangible and/or intangible, and positive and/or negative aspects associated with project costs and benefits (e.g., engineering, construction), quality (e.g., effectiveness, environment), etc. Each element was then assigned a rating by the selection group that established its importance in affecting project viability. A more detailed description of the criterion involved is provided on table 3.



VICINITY MAP
CANADA
U.S.A.
VANCOUVER
BELLINGHAM
MT. VERNON
EVERETT
SEATTLE
TACOMA
WASHINGTON
OREGON
PACIFIC OCEAN
N
SAMMAMISH RIVER
LAKE SAMMAMISH
LAKE WASHINGTON
RENTON
CEDAR RIVER
LANDSBURG SWD DIVERSION DAM
CHESTER MORSE LAKE
SCALE IN MILES
0 1 2 3 4 5
LAKE WASHINGTON SHIP CANAL
HIRAM M. CHITTENDEN LOCKS
PUGET SOUND
PUGET SOUND

Figure 1

Table 2

LAKE WASHINGTON SHIP CANAL WATER CONSERVATION PROJECT RECONNAISSANCE STUDY

ALTERNATIVE SELECTION MATRIX

ALTERNATIVE \ CRITERIA	ENGINEERING	REAL ESTATE	ENVIRONMENTAL	SAFETY	RECREATION	LAWS/ REGULATION	SPONSOR/ AGENCY ACCEPTANCE	ECONOMICS	AESTHETICS/ CULTURAL	POLITICAL	OPERATIONAL/ MAINTENANCE	CONSTRUCTIBILITY	EFFECTIVENESS	NAVIGATION	CATEGORY
1. New barrier @ narrow spot	–	o	–	o	o	o	o	–	o	o	–	–	o	–	A
2. Saltwater return system (DM No. 3)		work completed under O&M													A
3. Boat lift	+	o	+	o	o	o	+	o	–	o	–	o	+	–	B
4. Toll	o	o	o	o	–	–	o	o	o	–	–	o	+	–	A
5. Lockage schedule		currently implemented in the form of full lockages													A
6. Enlarge small lock	o	o	–	o	+	o	o	o	o	o	o	o	+	o	B
7. Balloon or diaphram	o	o	o	o	o	o	o	o	o	o	–	o	+	o	B
8. Raise summer lake level	o	–	–	–	–	–	o	o	o	–	–	o	o	–	A
9. Lower minimum lake level	o	–	–	–	–	–	o	o	–	–	–	o	o	–	A
10. Pump storage	o	o	o	o	o	o	o	o	o	o	–	o	+	o	B
11. Pump lock water into lake	o	o	–	o	o	o	o	o	o	o	–	o	+	o	B
12. Air curtains	o	o	o	o	o	o	o	o	o	o	–	o	+	o	B
13. Repl saltwater drain intake		currently adopted as structural alternative identified in the reconnaissance study													C
14. Operational modification		currently adopted as operational alternative identified in the reconnaissance study													C
15. Metro effluent for locks or to lake	o	o	o	o	o	–	o	o	o	o	–	o	+	o	B
16. Transfer of water between large and small locks	o	o	o	o	o	o	o	o	o	o	–	o	+	–	B
17. Pump saltwater in lock to overflow fresh into forebay	o	o	o	o	o	o	o	o	o	–	–	o	+	–	A

Legend: + = benefit o = insufficient information/affects unknown/neutral – = detriment/unacceptable impacts

Categories: A = Rejected for further consideration B = Reconnaissance level review in the start of feasbility C = Full feasbility level consideration

LWSC/POSSTBL.WK1

TABLE 3

CRITERIA

Engineering. Is there a current technology that supports this possibility? Acceptable to engineering practice?

Real Estate. Are property currently owned by the Federal government? Can property be acquired under normal real estate procedures?

Environmental. Are the effects to the environment harmful or beneficial? Are the harmful effects acceptable?

Safety. Are there any safety hazards associated with this alternative? Can these hazards be reduced to an acceptable level?

Recreation. Does this provide recreational benefits or reduce recreational activities?

Laws/Regulations. Are there laws or regulations that prohibit this work? Can the law or regulation be modified?

Sponsor/Agency Acceptance. Are these acceptable to the sponsor or agency policies, philosophies, or objectives?

Economics. Are there any economic benefits? Does this place a strain on the economy?

Aesthetics/Cultural Resources. Is the alternative aesthetic pleasing or at least acceptable? Does the alternative restrict cultural resources activities? Does the alternative ruin cultural resources value?

Political. Is the alternative political acceptable? Does it have political backing?

Operational/Maintenance. Does the alternative require additional operation and maintenance? Is the increase in O&M acceptable?

Constructibility. Can the alternative be constructed with current technology? Can technology be developed to construct this alternative?

Effectiveness. Does this alternative provide water conservation that may be translated into water savings realized by the sponsor? These possibilities certainly have a federal interest.

Navigation. Does the alternative hinder navigation? Does the alternative enhance navigation?

RATINGS

Importance ratings were assigned to each element using a plus (+) for being favorable, or beneficial relative to water savings; zero (0) for being neutral, requiring more information, or effects unknown; or a negative (-) for being difficult to analyze or implement, unacceptable, or requiring special consideration. In this analysis, for an alternative to be eligible for study in feasibility it must at least have ranked as a positive (+) under the criteria "water savings effectiveness". As complete agreement by all members of the evaluating group regarding the rating assigned is highly unlikely, the final rating assigned becomes one of a "group consensus."

CATEGORIES

Through group evaluation the alternatives were further classified under one of three action categories. The purpose of this analysis was to identify those alternatives that warranted further evaluation in the feasibility phase. The following summarizes the classifications:

1) Category A. Alternatives evaluated under this category were determined not to be effective in conserving water and producing consequent water savings by SWD or were heavily weighted with negative criteria ratings. These will not be analyzed further in the feasibility phase.

2) Category B. Alternatives evaluated under this category were determined to be effective in conserving water but insufficient information was available to make a final determination. The water benefits and/or cost of the alternatives were uncertain and therefore, could not be shown to warrant full analysis in the feasibility phase until at first being given a reconnaissance level evaluation at the very beginning of the feasibility study. Should any of these alternatives warrant further feasibility study, the IPMP will be revised.

3) Category C. Alternatives evaluated under this category were determined to be effective in conserving water and providing substantial water savings benefits and were expected to have favorable cost ratios. These alternatives warrant full consideration in the feasibility phase.

CONCLUSION

The matrix evaluation procedure presented in this paper did a good job of resolving the concern/dilemma over how to quickly/cheaply sort through the numerous alternatives to arrive at a short-list of those with the best possibility of producing a feasible project. This reduced the effort in scoping the work involved in preparing the IPMP. The procedure could be easily tailored to reduce some of the subjectivity by developing more definitive performance criterion, rating factors, or action categories. For example, criterion could be numerically weighted to reflect the significance/importance of certain criteria over others. Or, ratings could be redefined by using numeric values, more rating levels, or by providing more explicit definition of their intent. For example, the economics criteria might be better rated if a broad range of benefit/cost data, information, or ratios added. The product/summation of the various weighted and numerically valued components would then produce a ranked list of the possibilities. Categories could then be numerically established to more definitively screen the alternatives into action groups.

IPMP: A FLEXIBLE TOOL

by

Kenneth S. Cooper[1]

GENERAL

An old cliché often used to convince people to go about a job in an organized manner is "Plan your work and work your plan." While it sounds simple and straight forward, it will be successful only if everything goes as originally planned or if flexibility in the plan exists. An Initial Project Management Plan (IPMP) is the plan for work to be accomplished during the feasibility phase of a project. The IPMP is prepared near the end of the reconnaissance phase and is ultimately appended to the Feasibility Cost-Sharing Agreement (FCSA), a legally binding contract between the Corps of Engineers and our non-Federal partner for the project. An IPMP must include a delineation of tasks to be completed as part of the feasibility study, an identification of who is responsible for completing each task, an establishment of a cost function for each task, and a schedule of the timing and interrelationships of the tasks.

FUNCTION OF AN IPMP

An IPMP is an excellent tool for looking backward to confirm that all tasks have been completed on time and within budget. Rather than using this tool for micro-management and mapping where a study has been, it has another, more important reason for being. If treated as a living document, it can be used to look forward to define remaining work. The forward look begins during the early stages of the reconnaissance phase. Each team member should consciously attempt to identify all issues that will need to be resolved during the feasibility phase. These issues may arise based on personal experience or the result of some event or bit of data that surfaces during the reconnaissance phase. All of these issues should be brought forward when the IPMP is being formally developed. An issue raised by one team member might initiate a thought in another team member's mind regarding what work must be accomplished. These interrelationships are key to any study as most tasks are directly impacted by tasks completed by other team members.

SCOPE OF AN IPMP

It is very important that the IPMP builds upon the reconnaissance report findings; it should not reinvent that effort. The level of detail will obviously increase but collection of basic data should be undertaken once. To the extent practical, each subsequent iteration of effort should be a refinement of the previous analysis.

---

[1]Chief, Planning Division, Omaha District, U.S. Army Corps of Engineers

All team members must clearly identify the scope of each task that will become the IPMP. Specific definition will allow all team members to better understand the whole effort. The level of detail will also provide a basis for the proposed time and cost estimates. Additionally, the clear statement of task will ensure a balancing of level of detail among all elements of the team. The product will only be as accurate as the least accurate element of the total effort. Finally, and perhaps most importantly, a detailed scope at the outset will reduce or eliminate subsequent team strife by minimizing any misunderstanding on what is expected of each team member and how each task product relates to all others.

In scoping an IPMP, it is important to identify all tasks that are necessary to make a "go/no go" decision on moving toward construction. If the scope of study contains an effort that will answer all questions with absolute certainty, it is likely that the study cost will be prohibitive and there will be no local partner for cost-sharing. If, on the other hand, the scope of study contains an effort that provides inadequate detail to make a prudent decision, the resulting report will receive extensive review comments. A balancing of "nice-to-have" versus "got-to-have" information is essential. Each team must decide the appropriate level, subject to approval by reviewers, both within the Corps and at the local level.

Finally, although intuitively obvious, contingency time as well as contingency funding must be included. Minor adjustments in the IPMP can be handled with contingencies. It is a rare project that does not have a contingency fund. Even so, the lack of a block of contingency time can cause problems as schedules are closely monitored by the Corps and our partners. If contingencies are scoped at a reasonable level, it is reasonable to expect that some projects will cost less than the total amount available while others will exceed the cost. Currently, it is rare indeed to complete a study with funds remaining at the conclusion.

CHANGES IN AN IPMP

Even though it is important during the initial development of an IPMP to anticipate issues that could require a change, there are a number of unforeseen situations that can lead to modifications. Although not an exhaustive list, some of these issues are: changes in policy or guidance from higher authority, changes in physical conditions, changes in technology, changes in elected officials, changes in problem-solving strategy, changes due to review comments, and changes due to oversight.

Changes in policy or guidance from higher authority is a reality which all field staff must learn to accept. In an effort to improve the quality of a product or to streamline the way we do business, new policy is developed on an as-needed basis. A recent example of such a shift is the elimination of General Design Memoranda. While this will shorten the total time and reduce the total cost from problem identification to construction, it has forced a revision to the scope of a number of feasibility studies to strengthen the Engineering Appendix. Design must still occur even though it will be in the feasibility phase from now on.

Changes in physical conditions, not known or expected, can lead to the requirement for an IPMP modification. An obvious example of this would be discovery of a foundation condition not previously identified that would require extensive additional exploration or a major storm that might cause a shift in the basic hydrology for the study area. In either case, a modification to the IPMP would likely be required.

Improvements in technology can lead to adjustments to an IPMP. A very recent example is the new guidance on risk and uncertainty analysis for flood control studies. While this new approach will likely increase the quality of our product and may reduce the total project cost by building the necessary level of protection, the cost of a feasibility study will increase as will the time required to complete the effort. With a one year phase-in of this technology, some ongoing feasibility studies will need to be modified to use this new tool. An adjustment to the IPMP must precede the additional work.

Although it may not sound like a common event, two projects in Omaha District that were ready to begin the feasibility phase within the last year were located in cities that elected new mayors. With the shift in political perspective, negotiation of cost and tasks for the IPMP essentially started over. One of the projects now has a signed FCSA at the original cost with some variance in tasks. The other project is still being negotiated.

If there is a substantial shift in the problem-solving strategy for a feasibility study, it may be necessary to modify the IPMP. At the conclusion of the reconnaissance phase, the most efficient solution may appear to be an impoundment of floodwaters. As geotechnical studies occur, a foundation problem is discovered that, while resolvable, would increase the project cost to a level substantially above that of channel or levee projects. The shift in direction would shift the type of tasks and scope of studies. While the formulation element may not change appreciably, the technical engineering tasks may change substantially, necessitating an IPMP change.

Although no district consciously scopes an IPMP to yield review comments that will require more than a nominal effort, there are occasions where substantial review comments lead to significant increases in study effort. A modification to the IPMP may be necessary to complete the feasibility study.

A final reason leading to a modified IPMP is very real although it cannot be placed in the unforeseeable category. If an essential element of the study is forgotten when the IPMP is prepared and that oversight is not discovered before the IPMP is reviewed and implemented, a modification to the IPMP must follow. We recently had such an event in a project in Omaha District. Through a series of miscommunications, no contingency funding was included in the cost estimate or in the time estimate. A decision made jointly by the district and our partner resulted in a proposed IPMP modification to include a contingency rather than to continue the study with no flexibility in time or cost.

CONCLUSIONS

An IPMP is a tool to assist the project team in achieving the objective that is a finished feasibility study--on time and within budget. It is not an end product in and of itself. Its value is in being a forward-looking plan of the effort. Although adjustments should be kept to a minimum, an effective IPMP must be living in the sense of "subject to change as needed." Flexibility is essential to success as change is normally a foregone conclusion. The need for evolution in an IPMP needs to be recognized early on in an effort to minimize redundant or useless effort. It is also important to educate our local partner to the fact that an IPMP is not static and will likely evolve during the feasibility phase.

The effort should build upon knowledge gained and ignorance identified during the reconnaissance phase. It is improbable that the level of involvement by various offices will be consistent over a number of studies. The known information on a project area will vary from site to site. Therefore, in an effort to keep the level of detail in balance across technical functions, the tasks for each team member will reflect the needs of the specific project, not a generic list of standard tasks.

It is extremely important that the IPMP identify those tasks that need to be completed to make a reasoned decision. In this era of cost-sharing, it is also critical that only those tasks necessary to reach a reasoned decision are included. Too much or too little information demand from the IPMP will delay or stop an otherwise good project from moving on to construction.

Finally, an IPMP only can achieve its potential as a tool if it is properly used. If an IPMP is prepared in detail and not referenced again until the study is complete, it is of very limited utility. An effective IPMP must have a life to contribute value to the project.

INITIAL PROJECT MANAGEMENT PLAN
FOR
LOCAL FLOOD PROTECTION PROJECT
PETERSBURG, WEST VIRGINIA

by

William Haines,[1] Clifford Kidd,[2] and Dennis Seibel[3]

The City of Petersburg in Grant County, West Virginia, receives repeated flooding from the South Branch Potomac River. Following a severe flood in November 1985, the Baltimore District, Corps of Engineers began a study to examine methods for reducing future flood damages.

The study was completed in 1990 with a recommendation for construction of levees, floodwalls, and channels at an approximate cost of $20 million. The project was authorized for construction in the 1990 Water Resources Development Act.

The study was conducted in two phases - a reconnaissance phase and a feasibility phase. The cost-shared feasibility phase was one of the first in the nation, and it included both cash and in-kind service contributions from the local sponsor.

An initial project management plan (IPMP) was prepared and included as part of the feasibility cost-sharing agreement. The purpose of the IPMP was to establish the "game plan" for completing the feasibility phase on time and within budget.

A good "game plan" was especially important because the feasibility phase was being conducted on an accelerated two-year program, including the use of Federal funds, sponsor funds, in-kind services, and contractor services. The IPMP identified, at the outset, the work tasks, schedules, funds, expected products, and study team responsibilities.

The paper describes the method used to prepare the IPMP, the application of the IPMP during the feasibility study, and the usefulness of the IPMP from a variety of District perspectives (Economics, Hydrology and Hydraulics, and Study Management). Observations, reflections, and suggestions for improvement during future studies are also provided.

---

[1]Study Manager, Planning Division, Baltimore District, Corps of Engineers.

[2]Regional Economist, Planning Division, Baltimore District, Corps of Engineers.

[3]Chief, Hydrology-Hydraulics Section; Engineering Division, Baltimore District, Corps of Engineers.

INITIAL PROJECT MANAGEMENT PLAN

FOR

LOCAL FLOOD PROTECTION PROJECT

PETERSBURG, WEST VIRGINIA

I. Introduction

A. LFP - Petersburg, WV

1. One of first cost-shared studies

2. Successfully completed:

a. Reconnaissance - Sep 1987

b. Feasibility - Jan 1990

3. Authorized in 1990 for construction

4. Presently in PED phase

B. Purpose - to discuss development & use of IPMP

1. IPMP is 'game plan' for feasibility study

a. Tasks

b. Funds

c. Schedules

d. Products

e. Study team responsibilities

2. Discussion to include:

a. Project overview

b. IPMP preparation

c. IPMP use

d. H&H perspective

e. Economics perspective

f. Lessons learned

g. Observations about cost-shared studies

C. People

1. Dennis Seibel - Chief, H&H Section, Engineering Div

2. Cliff Kidd - Regional Economist, Planning Div

3. Bill Haines - Study Manager, Planning Div

II. Project Overview (BERH Hearing)

A. Location

1. WV panhandle

2. Senator Byrd turf

B. Study area

1. South Branch Potomac River

a. Residential & commercial - north

b. Commercial & industrial - south

c. Mountainous upstream, 1 mile wide floodplain

D. 2000+ residents

2. Issues = bulwarks, SCS levee/pump, bridge, industrial park

C. Flooding history & problems

D. Alternatives

E. Formulation options

F. Recommended project

1. Features (levees, walls, bridge mod, interior drainage, closures, environmental mitigation, cultural mitigation, channel excavation, acquisitions, flood warning)

2. Performance - 100-year design level

3. Economics

a. AAB = $2,589,000

b. AAC = $1,788,000

(fully funded estimate = $21.7million)

c. Net benefits = $801,000

d. BCR = 1.4

G. Project support/sponsors

1. Grant County

2. West Virginia

H. Time frame & cost

1. Recon = 1 year & $246,000

2. Feasibility = 2 years & $818,000

3. PED = 2+ years & $1,000,000

III. Steps in Developing IPMP for Petersburg

A. Assembled study team (veterans)

B. Defined project and alternatives (# of alternatives a source of concern)

C. Identified work tasks & products

1. Study manager developed preliminary list
2. Study team reviewed/commented
3. Study manager revised list

D. Estimated costs by task

1. Study team estimated costs for respective disciplines
2. Study manager assembled all costs (first cut > $2 million)
3. Study team and supervisors reviewed and adjusted

E. Prepared schedule

1. Study team estimated task durations and cash flow
2. Study manager developed CPM network (first cut > 3 years)
   a. Stress logic of task sequence
   b. Identify deliverables
3. Study team and supervisors reviewed and adjusted

F. Negotiated with sponsor

1. Sponsor reviewed list of tasks & products (without funding estimates)
2. Sponsor selected tasks for in-kind services
3. Study team developed detailed SOW for selected tasks
4. Sponsor reviewed SOW's
5. Study team/sponsor agreed upon:
   a. In-kind service package
   b. Feasibility study cost estimate
   c. Schedule, including cash flow by FY

G. Prepared FCSA package, including IPMP (see handout)

H. Requested/received FCSA approval from Division

I. District & sponsor signed FCSA

J. Duration/cost (Steps A - I) - approx 5 months/$40,000

IV. Use of IPMP

A. Identified cash flow requirements by year

1. COE annual budget requests

2. Sponsor cash

3. Sponsor in-kind service contributions

B. Assigned tasks

1. In-house

2. Contract

3. Other Corps districts

4. Other agencies

5. In-kind services

C. Allocated funds among work units

D. Established and monitored detailed schedule (also directs flow of information)

E. Measured performance

1. Time constraints

2. Funding limits

3. Product quality

F. Negotiated changes to IPMP

G. IPMP most useful at outset

V. H&H Perspective

VI. Economics Perspective

VII. Lessons Learned in Developing IPMP

A. Involve sponsor early & often

B. Critically review sponsor capability for IKS

1. Technical expertise

2. Timely performance

3. Familiarity with COE requirements

4. Include COE time/funds for 'hand-holding'

C. Program plenty of time & dollars for developing IPMP

D. Remain flexible; developing IPMP is iterative process requiring compromise and concurrence

E. Emphasize logic in developing CPM schedule

1. Think about work sequence

2. Avoid trap of fancy network programs before thinking about work tasks and products and flow of work

F. Communicate within study team, including sponsor

1. Informal is best

2. Work out problems earlier rather than later

G. No magic formula for success - lots of hard work

H. Role of study manager

1. Strive for concurrence

2. Be a benevolent dictator

VIII. Observations on Cost-Shared Studies

A. Management costs are high

1. Sponsor coordination

2. Numerous management levels

B. Need to better define appropriate level of detail (for all disciplines)

C. Cost sharing does NOT equal cost savings

D. H&H, Economics, Environmental, Design, & Cost Engineering need to communicate better

1. At all levels, incl Division and Washington

2. Cross-training necessary, including supervisors

E. Costly review process (TRC, FRC, WLRC, BERH, OCE, ASA, ETC)

F. Process sometimes overshadows product

G. K.I.S. - Keep it simple

SUMMARY OF SESSION 3: DEVELOPMENT AND UTILIZATION OF IPMP'S

This session included three papers and the final workshop summary. The papers consisted of policy and guidance for the preparation of IPMP's, as well as discussions on how to develop the H&H and Economic Components of the IPMP. The workshop concluded with summary and closing statements from Earl Eiker and Steve Cone.

Paper 11. R. Owen Reece, Hydraulic Engineer, H&H Branch, Norfolk District, presented a paper entitled "Policy and Guidance for the Preparation of IPMP's." Owen's presentation included a discussion on what guidance is currently available to assist in the development and application of IPMP's. Owen discussed the details of the guidance in the following areas: Requirement for IPMP; IPMP Development; IPMP Approval; IPMP Implementation; IPMP Modifications; Uses for the IPMP; Required Content of the IPMP; and Time frame for the IPMP. Owen further discussed conflicts and omissions in the guidance, and potential revision that could be made.

Paper 12. Michael W. Burnham, Chief, Planning Analysis Division, Hydrologic Engineering Center, presented a paper entitled "Use of Hydrologic Engineering Plans in Performing Flood Damage Reduction Studies." Michael's presentation summarized the basic elements of the Hydrologic Engineering Management Plan (HEMP). The benefits of using the HEMP were discussed, as well as the role that the HEMP plays in reconnaissance and feasibility studies. Michael stated that when possible, the existing conditions hydrologic engineering studies should be completed in the reconnaissance phase. The without-project conditions should be of sufficient detail and reliability so that the results can be used as a basis for determining if there are projects with a federal interest. Another important point that Michael made was that we, as an organization, do not spend enough time in the field. Specifically, our younger engineers need to spend more time in the field in order to gain a better understanding of the hydrologic processes that they are modeling. Michael concluded his presentation by presenting a case example HEMP that was developed for an interior flood engineering study for the city of Napa, CA

Paper 13. Rayford E. Wilbanks, Regional Economist, Economic and Social Analysis Branch, Vicksburg District, presented a paper entitled "Methodology Needed in the Development of an Economic Management Plan for an Urban flood Control Feasibility Study." Rayford's presentation summarized the basic elements of the Economic Management Plan (EMP). Rayford stressed the need for study team communication, especially between the economist, hydrologist, and hydraulic engineer. A flow chart outlining the economic tasks and their relationship to hydrologic and hydraulic tasks was reviewed. A major portion of Rayford's paper and presentation was devoted to outlining the tasks required for economic studies. These tasks included: identification of study scope and objectives; economic data collection and analysis of existing conditions; future land use without and with project; other damage/benefit categories; development of the PMP; and preparation of the economic appendix.

POLICY AND GUIDANCE FOR THE PREPARATION OF INITIAL PROJECT MANAGEMENT PLANS (IPMPs)

by

R. Owen Reece, Jr., P.E.[1]

BACKGROUND OF PAPER

The advent of cost-sharing partners' and project management division's involvement in the civil works planning process has created a need for careful examination of the activities required in the preparation of a Feasibility Report. The purpose of an Initial Project Management Plan (IPMP) is to detail the activities to be accomplished during the feasibility phase and present their associated costs and schedules. Discussions with HQUSACE personnel in CECW-EH and CECW-PD indicated a need to review the applicable guidance on IPMPs, detail their provisions, discuss conflicts and omissions, and suggest potential revisions. This paper should be of interest to all personnel involved with the development, review, or use of the IPMP.

PURPOSES OF PAPER

The purposes of this paper are:

List the applicable guidance for IPMPs

Detail the guidance in the following areas

Requirement for IPMP	IPMP modifications
IPMP development	Uses for the IPMP
IPMP approval	Required content of the IPMP
IPMP implementation	Time frame for the IPMP

Summarize, discuss conflicts and omissions, and provide potential revisions to the guidance.

LISTING OF GUIDANCE FOR IPMPS

The principal guidance and policy pertaining to the IPMP is found in the following two regulations.

[1]Hydraulic Engineer, Hydraulics and Hydrology Branch, U.S. Army Engineer District, Norfolk, VA.

ER Number	Issuing Office	Date	Title
1105-2-100	CECW-P	12/28/90	Guidance for Conducting Civil Works Planning Studies
5-7-1 (FR)	CECW-L & CECW-M	3/8/91	Project Management, Advance Copy

Additional information on the reconnaissance phase, where the IPMP is developed, is contained in the October 1988 CECW-P Memorandum, " Reconnaissance Phase Study Seminar."

GUIDANCE FOR IPMPS

NOTE: The following listing is taken directly from the referenced guidance unless noted. The notation for ER 5-7-1 (FR) used is (PM) and the notation for ER 1105-2-100 is (PL).

REQUIREMENT FOR IPMP

page I-B-1 (PM) All studies/projects are to be managed in accordance with an approved IPMP/PMP/CPM network as required by appropriate program sections.

page II-7 (PM) The agreed to IPMP shall be appended to the Feasibility Cost Sharing Agreement (FCSA). All projects that proceed into feasibility or a similar formulation study process, including those studies which are not cost shared will have an IPMP.

page 2-8 (PL) The IPMP, prepared and negotiated during the reconnaissance phase, documents the Federal and non-Federal efforts required to conduct the feasibility phase. It is appended to the FCSA.

page 2-22 (PL) During the reconnaissance study, an initial project management plan (IPMP) will be developed in accordance with ER 5-2-1. NOTE: ER 5-2-1 superseded by ER 5-7-1 (FR).

page 2-23 (PL) The IPMP is appended to the FCSA which is transmitted with the reconnaissance report.

page 2-29 (PL) ... all parties must agree to the funding schedule established in the IPMP.

Appendix E (PL) Appendix A, the Initial Project Management Plan, is hereby incorporated into this Agreement. The parties to this Agreement shall substantially comply with the Initial Project Management Plan in prosecuting work on the Study.

IPMP DEVELOPMENT

page II-3 (PM) The PM, under the direction of the DDE(PM), has overall responsibility for project: scope, quality, schedule, and cost. The PM provides overall leadership for planning, design and construction of the project. PM responsibility for integration of the study and project budget, cost, schedule, scope, and partner interface starts during the reconnaissance stage and extends through feasibility, design, construction, and into project operation. Projects or studies will be assigned to the PM by the DDE(PM) during the reconnaissance phase. ... While the district elements through the TM's retain responsibility for the development of their individual products, the PM is the leader and point of contact for the life of the project.

page II-4 (PM) As the primary point of contact with the partner, the PM ensures the development of agreements between USACE and the partner during the negotiations of such agreements as the FCSA, LCA, and Memorandum of Agreement.

page II-4 (PM) The PM manages the costs, budgets and schedules of the Feasibility Phase using the IPMP developed in conjunction with the TM's and the partner. The PM is responsible for achieving the corporate commitment embodied in the project management plans.

page II-7 (PM) The IPMP. During the reconnaissance phase of study, the IPMP is developed by the Planning Technical Manager in coordination with the PM, other TM's and the partner.

page II-8 (PM) The Planning TM will be responsible for the preparation of the FCSA in coordination with the PM. The PM will lead the district in negotiation, of the FCSA with the partner and any modifications thereto.

page II-8 (PMP) The PM is involved with the substantive technical development of the study in scoping the work packages, analyzing proposed scope changes, and in insuring that the deliverables of each work package fulfill the commitments made. Responsibility for the technical products and the methods of production are with the TM's and the technical organizations.

page II-12 (PM) The network will be developed in cooperation with the partner (non-Federal sponsor) and all TM's

page 2-12 (PL) Life cycle project management (LCPM) must be initiated during the reconnaissance study period to permit smooth implementation of LCPM ...

page 2-12 (PL) Appropriate Federal and state agencies shall participate in the development of the initial project management plan (IPMP) and the Project Management Plan (PMP).

page 2-27 & 2-28 (PL) While developing the IPMP which will be incorporated in the FCSA, the district commander must discuss with the prospective non-Federal sponsor(s) the objectives of the feasibility study, necessary level of detail, cost of studies, and scheduling of activities for the feasibility study. If desired and acceptable to the non-Federal sponsor, various project detail studies normally achieved after the completion of the feasibility phase could be scheduled for the feasibility study to reduce uncertainties in areas such as design and cost.

page 2-28 (PL) In accordance with ER 5-2-1 the PM will lead the district elements in preparation and negotiation of the FCSA. However, the SM is responsible for the technical accuracy of the FCSA. During negotiations the prospective non-Federal sponsor must be informed that the level of accuracy of alternative plan evaluation and cost estimates to be developed in the feasibility study will depend on the extent of uncertainties and the depth of investigations made during the feasibility study.

page 2-29 (PL) The responsibility for the preparation of the IPMP rests with the study manager, in coordination with the Project Manager.

IPMP APPROVAL

page 2-26 (PL) Certification is HQUSACE approval of the reconnaissance report; the negotiated FCSA; and the letter of intent (LOI) from the sponsor stating that the sponsor is ready, willing and able to execute the FCSA. NOTE: The IPMP is approved as a part of the FCSA.

IPMP IMPLEMENTATION

page II-4 (PM) The PM must work closely with the Planning Technical Manager, other TM's and the partner during the planning phase to insure full implementation of the IPMP with its corresponding study budget, schedule, scope of study, work tasks and assignments, and plan for reviews.

IPMP MODIFICATIONS

page II-8 (PM) Changes may be made to the IPMP in conjunction with the partner, the Planning Technical Manager, and the technical elements but must be approved by the PM. Significant changes to the IPMP may require a formal change request and modification of the FCSA. ... The PM will lead the district in negotiation, of the FCSA with the partner and any modifications thereto.

page II-10 (PM) Once a baseline cost estimate has been established, unanticipated changes in scope, schedule, etc. will be accommodated with no change in total project costs so long as sufficient contingencies exist to ensure project completion. The prudent and judicious management of contingencies to accommodate uncertainties in the project is the shared responsibility of district and division management. The project cost estimates have contingencies associated with each feature/sub-feature.

page II-10 (PM) The Baseline Estimate for a cost shared feasibility effort is established in the Feasibility Cost Sharing Agreement (FCSA). The FCSA may have provisions to facilitate changes to the feasibility cost (Baseline) up to a limit, also provided for in the FCSA, which is mutually agreed to by both the District and the partner. Not withstanding these internal FCSA provisions, cumulative increases to the FCSA Estimate for Feasibility Studies of the lesser of 25% of the FCSA Estimate of the original approved FCSA, or $1 million must be approved at the division level. Requests for increases to the FCSA Estimate for Feasibility

Studies over the lesser of 25% or $1 million, must be submitted to the Director of Civil Works, attention CECW-L.

page II-12 (PM) The baseline feasibility schedule is established in the FCSA for a cost-shared Feasibility effort ... The division may approve cumulative increases to the baseline Schedule of up to 25% of the duration of the baseline schedule, provided that the increase does not affect the date of the Division Engineers Notice. Requests for changes to the baseline schedule greater than 25% in duration, or requests for changes to the date of the Division Engineers Notice, must be submitted to the Director of Civil Works, attention: CECW-L.

page 2-29 (PL) During the conduct of the feasibility phase, significant changes to the IPMP will require a modification of the FCSA.

page 2-29 (PL) Should the "review support" costs exceed the 5 percent of total study cost or $50,000, whichever is less, the FCSA will be modified to provide for 50-50 sharing of these additional costs.

Appendix E (PL) Appendix A, the Initial Project Management Plan, is hereby incorporated into this Agreement. The parties to this Agreement shall substantially comply with the Initial Project Management Plan in prosecuting work on the Study. The following modifications, to be approved by the Executive Committee, shall require an amendment to this Agreement:

a. any modification which increases the total Study Costs by more than __ percent (percent to be negotiated with 15% maximum)

b. any modification in the estimated cost of a Study work item or any obligation for a Study work item, which changes the total cost of that work item by more than __ percent (percent to be negotiated with 15% maximum)

c. any extension of the completion schedule for a Study work item or more than thirty (30) days

d. any reassignment of work item between the Sponsor and the Government

USES FOR THE IPMP

page I-B-1 (PM) Commanders will manage, analyze and control project/study cost, schedule and budget in accordance with the approved IPMP or PMP. The responsibility and authority for compliance (enforcement) will be delegated through the DDE(PM) to the PM. However, management of budgets for technical products within the agreed upon authorized budget in the PMP is still the responsibility of the functional chiefs who must be held accountable. PM control and enforcement of overall project funds does not relieve functional chiefs of this duty.

page II-4 (PM) The PM manages the costs, budgets and schedules of the Feasibility Phase using the IPMP developed in conjunction with the TM's and the partner. The PM is responsible for achieving the corporate commitment embodied in the project management plans.

page II-7 (PM) An Initial PMP (IPMP) is used to plan, define, and control the development and delivery of the products of this first stage.

page II-7 (PM) The IPMP will be used by the PM, TM's, and the partner to ensure that the work required to be performed in the Feasibility Phase has been carefully developed and considered.
page II-7 (PM) The IPMP will also include a Work Breakdown Structure for the study phase, compiled into a network which can be used as the basis for assigning tasks within USACE and to the partner, as well as establishing the value of in-kind services from the partner. ... the IPMP

must include a mechanism which allows the PM to measure the progress and performance of all study efforts.

page II-9 (PM) Civil Works projects are managed by the PM through use of a work breakdown structure (WBS) as described in Appendix II-A.

page II-12 (PM) The PM is to ensure that the progress of the study or project is in accordance with the approved schedules and networks. During the development of the IPMP and continuing through the development of the PMP, major milestones will be associated with a percentage completion and will be defined in the PMP.

page II-12 (PM) The PM will manage, analyze, allocate and control all project and study costs and budgets in accordance with the approved IPMP or PMP.

page 2-4 (PL) Division Commander's Responsibility Reviewing and approving the district commander's reconnaissance report. ... Developing the division fiscal planning program; ensuring district commanders obtain appropriate evidence of support for studies from non-Federal sponsors, prior to study initiation; recommending capabilities; and submitting requests to HQUSACE for funds transfers.

page 2-5 (PL) Planning Division, HQUSACE Responsibility Certifying those reconnaissance reports which clearly meet current policy and budgetary criteria for conducting the feasibility studies. Releasing funds to initiate the feasibility phase upon receipt of a signed feasibility cost sharing agreement (FCSA) and a request for funds. Recommending the fiscal planning program based on the recommendations of division commanders, for inclusion in the President's Budget, including recommending specific studies and projects ... and proper amounts for each; commenting on field proposals for establishment of capabilities; ... and recommending actions to be taken on fund transfers.

page 2-8 (PL) The IPMP, prepared and negotiated during the reconnaissance phase, documents the Federal and non-Federal efforts required to conduct the feasibility phase. It is appended to the FCSA.

page 2-20 (PL) An estimate of time and costs for the feasibility phase. NOTE: A purpose of the reconnaissance study.

page 2-21 (PL) They will be supported by scopes of study of sufficient detail to allow review by the non-Federal sponsor, and will serve as the basis for assigning tasks and establishing the dollar value for in-kind contributions should the non-Federal sponsor elect that option.

page 2-26 (PL) Certification is HQUSACE approval of the reconnaissance report; the negotiated FCSA; and the letter of intent (LOI) from the sponsor stating that the sponsor is ready, willing and able to execute the FCSA.

page 2-28 (PL) An IPMP, negotiated between the Corps and the non-Federal sponsor, will ensure that the work required for the feasibility phase has been carefully developed and considered. The IPMP forms the basis for estimating the total study cost and local share. It also is the basis for assigning tasks between the Corps and the sponsor and for establishing the value of in-kind services.

page 2-28 (PL) The IPMP will guide the allocation of study funds among tasks to assure that all interests are given adequate attention.

page 2-29 (PL) The total cost of the feasibility phase will be established through negotiation of the IPMP.

Appendix E (PL) The term "Negotiated Cost" is the fixed fee for a work item to be accomplished by the sponsor as in-kind services as specified in the Initial Project Management Plan incorporated herein and which is acceptable to both parties.

REQUIRED CONTENT OF THE IPMP

page II-7 (PM) The IPMP will include a baseline estimate of total study costs, including a breakout of all non-Federal costs and activities to be performed by the partner.

page II-8 (PM) The IPMP must address the efforts needed to complete the Feasibility Study, including:

(a) The work breakdown structure and associated work tasks and their milestones, costs, and assignment of responsibilities for accomplishment.

(b) A mechanism for measuring the progress and performance of all study efforts.

(c) USACE and other criteria required to assess the adequacy of the completed work effort and to ensure that the study conforms to all existing Federal policies.

(d) Procedures for reviewing and accepting work of all parties.

(e) Schedule of performance as represented in the network.

(f) Coordination mechanism between all parties.

(g) Reference to statues, regulations, and other guidance needed to conduct the work.

(h) An allowance for the partner's participation in reviews, including Washington level.

page II-9 (PM) Both the IPMP and PMP will assure the following specific issues are addressed:

(1) Roles of the Corps of Engineers and the partner during the planning, land acquisition, engineering, design, and construction phases of the project.

(2) Rights and obligations of both parties during the planning, land acquisition, engineering, design, and construction phases of the project.

(3) Level of participation of both parties during the planning, land acquisition, engineering, design, and construction phases of the project.

(4) Responsibilities of both parties during the planning, land acquisition, engineering, design, and construction phases of the project.

page II-12 (PM) The level of detail of the alternative plan evaluation and the scope of detailed studies normally achieved after the completion of feasibility but executed under feasibility to reduce uncertainties must also be included in the network development. The network as part of the IPMP will be presented to the Reconnaissance Review Conference (RRC) for approval and comment and adjustment as required before continuing with the study.

page II-12 (PM) During the development of the IPMP and continuing through the development of the PMP, major milestones will be associated with a percentage completion and will be defined in the PMP.

Appendix II-A (PM) NOTE: This appendix provides additional discussion on PMPs and the required contents.

Following are twenty one (21) elements which must be considered by the PM when developing the PMP for Civil Works undertakings. The twenty one elements comprise the body of the PMP with summary information for each element. Detailed or referenced material should be included in the appendix.

NOTE: The following is a list of the twenty one elements.

Scope of Work
Work Breakdown Structure (WBS)
Organizational Breakdown Structure (OBS)
Responsibility Assignment Matrix (RAM)
Schedules
Budgets and Cost Estimates

Current Benefits Plan
Resource Allocation Plan (RAP)
Local Cooperation Plan
Acquisition Plan
Real Estate
Total Quality Management Plan (TQM)
Value Engineering Plan
Safety Plan
Security Plan
Cultural Resource Plan
Environmental Plan
Operation and Maintenance Plan
Management Control Plan

Reporting Requirements
Change Control Plan
PMP Appendix

A PMP is not complete until all parties thereto have provided their signatures to document their concurrence and agreement with the plan. Table II-A-6 provides a sample format to document the required coordination.

page 2-10 (PL) Until the feasibility phase is initiated, all study cost estimates will be prepared so that the reconnaissance phase cost will not exceed 25 percent of the cost of the total study (reconnaissance phase plus feasibility phase) cost. This is intended to ensure that the level of detail in the reconnaissance study is not excessive, compared to that of the feasibility phase, to avoid inappropriate reduction of the non-Federal costs. This requirement is void after the FCSA is executed.

page 2-12 (PL) All efforts should be made to accelerate project development and implementation while maintaining engineering quality and controlling costs and schedules. NOTE: At the time of publication Engineering regulations were forthcoming which would detail the necessary procedures (and level of detail).

page 2-21 (PL) The estimate of costs for the feasibility phase will be developed in the IPMP in appropriate Code of Accounts format. The cost estimates will be based on sufficient information to minimize the likelihood of substantial changes. They will be supported by scopes of study of sufficient detail to allow review by the non-Federal sponsor, and will serve as the basis for assigning tasks and establishing the dollar value for in-kind contributions should the non-Federal sponsor elect that option. Because of the non-Federal sponsor's need, an estimate of the cost for each task is required.

page 2-27 (PL) The model FCSA shall be followed for all agreements, but minor adaptations may be made to accommodate individual study circumstances.

page 2-28 (PL) The determination of the dollar value of in-kind products or services will be negotiated, based on a detailed government estimate and sponsor proposal, between the Federal Government and the non-Federal sponsor as fixed fee items, applying applicable

Federal regulations, including OMB Circular A-87. The dollar value of the in-kind effort will be established prior to the initiation of the in-kind effort. Acceptance of the product will be as called for in the IPMP.

page 2-28 (PL) The IPMP should include the costs for the tasks which non-Federal sponsors have historically accomplished without charge, such as: supervision and administration; study management; attendance at meetings, both public and technical; and overhead and indirect costs which are directly related to the feasibility study. It is expected that detailed scopes of work may be need for individual items in the IPMP. Work items will also include those tasks typically necessary to support the review process from the signing of the report through the ASA(CW)'s request to OMB for the views of the Administration. These items could include comments, attending Washington level meetings (including the non-Federal sponsor), and minor report revisions as a result of review by higher authority.

page 2-28 & 2-29 (PL) As a minimum, the IPMP should address: work tasks, and their milestones and negotiated costs, and the responsibility for their accomplishment; Corps and other professional criteria to assess the adequacy of the completed work effort; procedures for reviewing and accepting the work of both parties which can be audited; the schedule of performance; the coordination mechanism between the Corps and non-Federal sponsor; and reference to regulations and other guidance that will be followed in conducting the tasks.

page 2-29 (PL) The IPMP will address the appropriate level of engineering detail required for the feasibility phases. Engineering studies and analysis should be scoped to the minimum level needed to establish project features and elements that will form an adequate basis for the project construction schedules and cost estimate. Uncertainties should be reflected in contingencies which will be resolved during feasibility and/or PED.

page 2-29 (PL) To ensure that the sponsor is afforded the opportunity to participate in any significant effort as a result of Washington level review, "review support" will be included as a work item in the IPMP for district and non-Federal sponsor costs on;y. These costs, including any necessary travel, will be limited to those reasonable costs associated with the review and processing of the feasibility report. This item will be 5 percent of the total study cost or $50,000, whichever is less, and will be cost shared equally.

page 2-29 (PL) The cost estimate in appropriate Code of Accounts format will identify major costs by task and by type (i.e., labor, materials, equipment, indirect cost, etc.), and be fully supported and documented.

page 2-29 (PL) Should the "review support" costs exceed the 5 percent of total study cost or $50,000, whichever is less, the FCSA will be modified to provide for 50-50 sharing of these additional costs.

TIME FRAME FOR THE IPMP

page II-7 (PM) The first stage covers the planning products from completion of the reconnaissance studies through completion of the feasibility study (signing of the Division Engineer's Notice).

page II-12 (PM) The network as part of the IPMP will be presented to the Reconnaissance Review Conference (RRC) for approval and comment and adjustment as required before continuing with the study.

page 2-8 (PL) Reconnaissance Phase The reconnaissance phase commences with the obligation of appropriated reconnaissance funds, and terminates with the execution of a FCSA or the division commander's public notice for a report recommending no Federal action.

Reconnaissance Study Period The reconnaissance study, part of the reconnaissance phase, begins with the obligation of appropriated reconnaissance funds and concludes on the date of the district commander's submission of the final signed reconnaissance report to the division commander. This technical planning study will be limited to 12 months. Under unusual circumstances extension to 18 months may be granted in accordance with Sec 905b of the WRDA '86.

Negotiation Period This permissible period, used to finalize the FCSA, is part of the reconnaissance phase; it starts with the district commander's submission of the final reconnaissance report to the division commander and ends three months later or with the submission of a negotiated FCSA to the division commander, whichever is earlier.

page 2-8 (PL) The IPMP, prepared and negotiated during the reconnaissance phase, documents the Federal and non-Federal efforts required to conduct the feasibility phase. It is appended to the FCSA.

page 2-23 (PL) Since the FCSA negotiating period extends beyond the time of report completion, the final FCSA and IPMP will not normally be included in the report.

Activities between the time the reconnaissance report is signed by the district commander and the time feasibility phase funds are provided to the district commander, normally will be carried out in 6 months or less, and include: negotiating an FCSA; holding the mandatory RRC; Division and Washington level review; and certification. ... Nothing herein requires utilization of the negotiating period, which shall not exceed 3 months in any event. ... Division review will be limited to 30 days from the submission of the reconnaissance report or the negotiated draft FCSA, whichever is later.

page 2-26 (PL) RRC It shall be held concurrently with the 30 day division review of the reconnaissance report, and can occur during, prior to or after negotiating the draft FCSA.

page 2-27 (PL) After certification is finished, the remaining activities in this phase are: release of the reconnaissance report to the public by the division commander; execution of the FCSA by the district commander and the non-Federal sponsor; and HQUSACE release of funds to initiate the feasibility phase. All three activities should be accomplished in less than a month after certification.

Appendix E (PL) The term "Study Period" shall mean the time period for conducting the Study, commencing with the issuance of initial Feasibility funds following the execution of this Agreement, and ending when the report is submitted to the Office of Management and

Budget (OMB) by the Assistant Secretary of the Army for Civil Works (ASA(CW)) for review of consistency with the policies and programs of the President.

DISCUSSION OF GUIDANCE

REQUIREMENT FOR IPMPS

The requirement for an IPMP is well documented in both the Project Management and Planning guidance. In fact, the Planning guidance references the Project Management guidance in stating that "an initial project management plan (IPMP) will be developed in accordance with ER 5-2-1". The requirement for the IPMP to be appended to the FCSA is in both ERs and a requirement for agreement on the funding schedule is included in the Planning guidance.

There are no apparent conflicts in the guidance relating to the requirement for the IPMP.

IPMP DEVELOPMENT

The responsibility for the development of the IPMP is defined in the guidance. Both documents indicate that the SM/Planning TM is to prepare the IPMP, along with the FCSA, in conjunction with the PM, other appropriate district elements, the partner, and appropriate Federal and state agencies. As the primary point of contact, the PM is specified as being the leader of the negotiations with the non-Federal sponsor in the development of the IPMP. Additionally, the Planning guidance puts some requirements on the district commander for discussions with the non-Federal sponsor.

The planning guidance should be revised to reflect that the DDE(PM) can present the items concerning the IPMP currently required of the district commander. Additionally, the Project Management guidance should include the reference to "coordination with appropriate Federal and state agencies" and define the PM's role in that coordination process.

IPMP APPROVAL

Neither document adequately details the approval of the IPMP. The Planning guidance does indirectly address the approval of the IPMP in discussing the certification of the reconnaissance report. One of the requirements for certification is HQUSACE approval of the "negotiated FCSA" which will include the IPMP as an appendix.

Both documents should be revised to include the responsibility and process for the approval of the IPMP. Even if the responsibility and process rest with the HQUSACE's certification of the reconnaissance report, it should be stated in both the Project Management and Planning guidance.

IPMP IMPLEMENTATION

The Project Management guidance states that the "PM must work closely with the Planning Technical Manager, other TM's and the partner during the planning phase to insure full implementation of the IPMP". There is no mention of this aspect of the study in the Planning guidance.

There should be a corresponding statement in the Planning guidance referencing the fact the implementation of the IPMP is a shared responsibility of all participants in the study.

IPMP MODIFICATION

The two documents discuss modifications to the IPMP in the following six areas:

1. According to the Project Management guidance the PM must approve all changes to the IPMP. There is no mention of the approval for changes to the IPMP in the Planning guidance.

2. The Planning guidance states that "significant changes to the IPMP will require modification of the FCSA", while the Project Management guidance indicates that "significant changes to the IPMP may require ... modification of the FCSA".

3. The Project Management guidance provides for the management of contingencies to allow for the uncertainties in scope and schedule. There is no mention of contingencies or their management in the Planning guidance.

4. The Planning guidance makes the provision that "Should the "review support" costs exceed the 5 percent of total study cost or $50,000, whichever is less, the FCSA will be modified to provide for 50-50 sharing of these additional costs.". The Project Management guidance makes no reference to this specific condition.

5. The Project Management guidance indicated that the FCSA will establish the baseline study cost and schedule for the project. There is no corresponding reference to the baseline study cost or schedule in the Planning guidance.

6. Both documents list situations where changes to the IPMP will require modification to FCSA. The following is a summary of those conditions.

   Project Management - Cumulative increases to the FCSA Estimate for Feasibility Studies of the lesser of 25% of the FCSA Estimate of the original approved FCSA, or $1 million must be approved at the division level. Requests for increases to the FCSA Estimate for Feasibility Studies over the lesser of 25% or $1 million, must be submitted to the Director of Civil Works. The division may approve cumulative increases to the baseline Schedule of up to 25% of the duration of the baseline schedule, provided that the increase does not affect the date of the Division Engineers Notice. Requests for changes to the baseline schedule greater than 25% in duration, or requests for changes to the date of the Division Engineers Notice, must be submitted to the Director of Civil Works.

Planning - The following modifications, to be approved by the Executive Committee, shall require an amendment to this Agreement:

a. any modification which increases the total Study Costs by more than __ percent (percent to be negotiated with 15% maximum)

b. any modification in the estimated cost of a Study work item or any obligation for a Study work item, which changes the total cost of that work item by more than __ percent (percent to be negotiated with 15% maximum)

c. any extension of the completion schedule for a Study work item or more than thirty (30) days

d. any reassignment of work item between the Sponsor and the Government

This area needs considerable thought since it directly effects the quality of the IPMPs which currently exist. The requirement that the PM manage contingencies will tend to make the individual work items more costly if the support elements do not expect to be able to access these contingencies during the feasibility study. Additionally the requirement for a formal modification to the FCSA anytime an individual study item either increases 15 percent in cost or 30 days tends to result in broad, loosely defined work tasks. This provides needed flexibility for the managers of the support elements within the district in the accomplishment of their feasibility study activities.

One of the purposes of the IPMP is to ensure that the work to be done in the feasibility phase has been thoroughly considered. With the level of detail provided in the approximately 20 IPMPs reviewed for this effort, it is generally impossible to adequately determine the work tasks to be accomplished in the feasibility phase. It is recommended that the following actions be undertaken to alleviate this condition:

1. Provide consistent guidance in both documents for the following areas:

   o Include the provision for PM approval of all changes to the IPMP in the Planning guidance.

   o Define significant changes to the IPMP as those specified for mandatory modifications to the FCSA in the Project Management guidance.

   o Include the additional "review support" costs provision in the Project Management guidance.

   o Specify the baseline study cost and schedule in the Planning guidance.

2. Adopt the requirements of the Project Management guidance with regards to mandatory changes to the FCSA and the approval process. This should relieve the concern of the support elements for causing a mandatory change to the FCSA if any one minor work task slips, in cost or schedule, without adversely impacting the overall study effort. It will also allow the support elements in the district the flexibility to manage their feasibility study efforts.

3. Allow the PM, in coordination with the non-Federal sponsor, to control the cost of work efforts, such as H&H studies, through the use of unauthorized charges as is provided for in the Project Management guidance.

4. Encourage the PM to strike a balance on contingencies, where the support elements are encouraged not to pad their estimate to cover the contingencies the PM will not release and the PM releases contingencies when reasonable unforeseen circumstances arise in the work tasks of the support elements.

5. Encourage the support elements, through the PM and their stovepipes, to fully document their scopes of work for the feasibility phase. Show the support elements through use of the IPMP in the review process, how it is to their benefit to fully document their tasks.

USES FOR THE IPMP

The two documents do a good job of detailing the uses of the IPMP. The principal uses include the following:

Plan the work effort for the feasibility phase
Establishment of baseline study cost and schedule
Establishment of Federal and non-Federal share of costs
Assignment of work tasks for feasibility phase
Establishment of non-Federal in-kind work effort
Certification of reconnaissance report
Management of Feasibility study effort
Measure the progress of the feasibility phase

The only area the Project Management guidance is lacking in, as compared to the Planning guidance, is relating the certification of the reconnaissance report to the successful completion to the IPMP.

There is one additional area in which both the Project Management and Planning guidance are silent on. This is the use of the IPMP in the review process for the feasibility report. Currently, there is no involvement by either the Washington Level Review Center (WLRC), the Board of Engineers for Rivers and Harbors (BERH), or the Office of the Assistant Secretary of the Army for Civil Works (ASACW). Each of these play vital roles in the successful processing of feasibility reports. Two recommendations are offered to aid in this process.

First would be to involve each of these offices in the review and approval of the IPMP. This would give these offices an opportunity to highlight areas of concern and get corrective actions into the IPMP prior to the initiation of the feasibility phase. This could be accomplished in conjunction with the reconnaissance review conference in an effort not to slow the current process down appreciably.

The second area is in the use of the IPMP during the review of the feasibility report. Currently, it is not mandatory for the IPMP to be used a basis for the evaluation of the feasibility report. It is recommended that this be done in conjunction with the previous recommendation. This will encourage the districts to fully describe the procedures, policies, criteria, etc. they will use in the accomplishment of the feasibility study in the IPMP since they could then use that approved document in defense of their feasibility report in the review process. While recognizing that criteria that effects project safety, performance, selection, or changing administration policies would need to be addressed by the feasibility report regardless of when the criteria is adopted, reviewers must be encouraged to be sensitive to the position of the districts with respect to the non-Federal sponsor during the review process.

REQUIRED CONTENT OF IPMP

The Project Management and Planning guidance both contain an extensive list of required items for the IPMP. While all of the items are worthwhile, one consistent list should be developed and incorporated into both documents. This will provide consistency which will enhance the ability of higher authority to review, analyze, and approve the IPMP.

One extensive problem found during the review of approximately 20 IPMPs was the lack of consistency in the breakdown of the feasibility costs. A better job must be done in getting the districts to break their costs down in the Code of Accounts. The variations from district to district, in both the accounts used and the types of estimated study cost within a single account, make it impossible for higher authority to track average study costs per activity. While recognizing that each study situation is unique, it is valuable for reviewers to be able to spot wide variations from the average for similar tasks. A couple of examples of this inconsistency follow:

One IPMP out of the 16 where cost breakdowns were available included 37.5% of its $ 2.1 million dollar feasibility study in Supervision and Administration, while another IPMP from the same office listed no Supervision and Administration on a $ 400,000 feasibility study. Only half of the division's with IPMPs utilized the Supervision and Administration account in their IPMPs.

Another IPMP included $ 92,000 for the categories PMO Program Maintenance, Budget Preparation, and Division Support on a $ 2.115 million dollar feasibility study, while another IPMP from the same office did not list these categories on a $ 3.240 million dollar feasibility study.

TIME FRAME OF IPMP

The Project Management guidance's only time requirement is for the network as part of the IPMP to be presented at the RRC. The Planning guidance is much more detailed on when activities must be accomplished in completing the reconnaissance phase which includes completing the IPMP. Since there is lack of timing references in the Project Management guidance there are no conflicts with the Planning guidance but the Project Management guidance should include a reference to the Planning guidance to indicate agreement with the discussion included there.

There is a problem with the definition of the time period the IPMP is supposed to cover. The Project Management guidance states "The first stage covers the planning products from completion of the reconnaissance studies through completion of the feasibility study (signing of the Division Engineer's Notice)." which is to be covered by the IPMP. The Planning guidance in the model FCSA (which all districts must utilize) indicates the study period "shall mean the time period for conducting the Study, commencing with the issuance of initial Feasibility funds following the execution of this Agreement, and ending when the report is submitted to the Office of Management and Budget (OMB) by the Assistant Secretary of the Army for Civil Works (ASA(CW)) for review of consistency with the policies and programs of the President". Since the period in the Planning guidance corresponds to the time the non-Federal sponsor must cost-share in the study, it is appropriate to revise the Project Management guidance to reflect the IPMP covering the entire study period.

USE OF HYDROLOGIC ENGINEERING MANAGEMENT PLANS IN PERFORMING FLOOD DAMAGE REDUCTION STUDIES

by

Michael W. Burnham[1]

INTRODUCTION

The importance of Hydrologic Engineering Work Plans (HEMP's) as a management tool is becoming more apparent as the Corps' two-phase planning study (WRDA, 1986 and USACE, 1991) process evolves. This is especially true as federal funding for water projects declines and with the greater emphasis now being placed on study coordination and project management. Additionally, local sponsors are requesting more in-depth justification of the study analytical procedures and often desire to participate with in-kind technical services to meet cost-shared funding obligations. These actions have produced greater competition for study funds and a need for justification of required technical analyses. Unfortunately, the technical studies resources needed to formulate and evaluate viable flood damage reduction measures are oftened reduced to meet these other study requirements.

Hydrologic Engineering Management Plans represent a management tool that can significantly enhance the study efficiency and products. A well developed HEMP is a document that presents a thoroughly conceived study strategy and analysis methods, work schedule, work item cost estimates, and staffing assignments. The document may be used internal to the hydrologic engineering office as well as formally at key study milestones to document hydrologic engineering study requirements. The formal application utility is presented herein. As such, the HEMP may be used for integrating the hydrologic analysis with other disciplines, negotiation for resources allocation, and for obtaining consensus of the hydrologic engineering study approach with the study/project manager and others including the local sponsor.

This paper summarizes the basic elements of the HEMP's, discusses the benefits of using HEMP's, describes the plan development process, and presents a case example plan developed for an interior flood hydrologic engineering study for the City of Napa, CA.

ELEMENTS OF HYDROLOGIC ENGINEERING MANAGEMENT PLANS

General. The HEMP serves as the technical guide for the hydrologic engineering analysis and is the basis of firm schedule and cost commitments for the study conduct. Most HEMP's should be developed by the engineer assigned the lead for the study, normally a

[1]Chief of Planning Analysis Division, Hydrologic Engineering Center, U.S. Army Corps of Engineers

senior engineer. In some studies, the supervisory engineer may develop the HEMP. For other studies, a junior engineer may develop the HEMP under the direction of the supervisor or assigned senior engineer.

Strategy and Methods. The principal element of the hydrologic engineering management plan is the definition of the study strategy and methods to be applied. It is the foundation from which the scheduling, cost estimates, and staffing requirements are developed. Previous or generic work plans (USACE, 1992a) may be used as guides or tailored to the particular study. The study strategy definition may be developed and presented in an annotated outline format, typically to three or four headings levels, although this will vary depending on the type and complexity of the study. The detail may evolve via periodic updates as the study processes.

Development of the hydrologic engineering strategy should be based on gaining a good understanding of the key issues and concerns to be addressed in the analysis. The type of study and study objectives should be clearly understood and defined. Key aspects of the study to be addressed include: definition of the major issues (flood damage, environmental, social, etc.) and likely methods to be used to perform the analysis; level of detail of the analysis; available hydrologic information and requirements; interface with other disciplines; unusual features; study boundaries; and likely alternatives.

The formulation of the hydrologic engineering strategy and procedures are based on discussions with peers, study/project managers, and other discipline staffs, review of available information including previous studies, and field reconnaissance of the study area. (USACE, 1992a)

Scheduling. Scheduling of key hydrologic engineering tasks must consider the study milestones, needs of other disciplines for the hydrologic engineering information, and the availability of the staff to perform the study. Normally, Gant or Bar chart type schedules are appropriate depicting one or two heading levels for the tasks and showing the major milestone dates. If problems are identified with scheduling, adjustment to the tasks defined for the hydrologic engineering study strategy may be required. The consequences of such actions should be noted and documented in a Memorandum for Record.

Study Costs. Cost estimates are derived from the study tasks. The estimates should be based on salary and overhead costs associated with the grade levels of the mix of the hydrologic engineering staff that will perform the analysis.

Staffing. The assignment of staff to conduct a hydrologic engineering study is generally the responsibility of the supervisory hydraulic engineer. Often it is best to have junior engineers work under the general guidance of senior engineers until experience is gained. Studies where experience and judgment are important to reaching a viable result are often best performed by senior engineers.

BENEFITS OF HYDROLOGIC ENGINEERING MANAGEMENT PLANS

Overview. The development of the HEMP can take significant effort, often five or even 10 percent of the entire hydrologic engineering study costs. However, the benefits associated with a good HEMP can be substantial as discussed in subsequent paragraphs.

Focussed and Integrated Analysis. A viable HEMP requires the hydrologic engineer to think through the study process, methods, and strategy prior to initiation of the study. Key issues are identified and methods for analysis to address those issues are clearly documented. This reduces false starts, minimizes problems with data integration and scheduling with other participating disciplines, and reduces the amount of inappropriate analysis scope and detail. It also enables documentation and referencing hydrologic engineering regulations required for particular types of studies.

Reviews. A major advantage of a HEMP is the proposed strategy and resources requirements are documented and thus can be reviewed and critiqued by peers, supervisors, other disciplines, study/project managers, and outside agencies and the local sponsor. This more open forum ultimately leads to better and more efficient analysis with far fewer acceptance problems throughout the progression of the study.

Negotiations. An HEMP provides a means for the hydrologic engineering study effort to be negotiated and the consequences changes in scope/detail, funding, and staffing to be clearly defined. The paramount negotiation should be with the study/project manager for time and funding requirements. The hydrologic engineer must realize the needs of other disciplines and that the study resources are limited. The document is also applicable for in-kind service negotiations of portions of the hydrologic engineering analyses by the local sponsor. The HEMP enables the consequences of needed study adjustments to be readily accounted for as the study evolves.

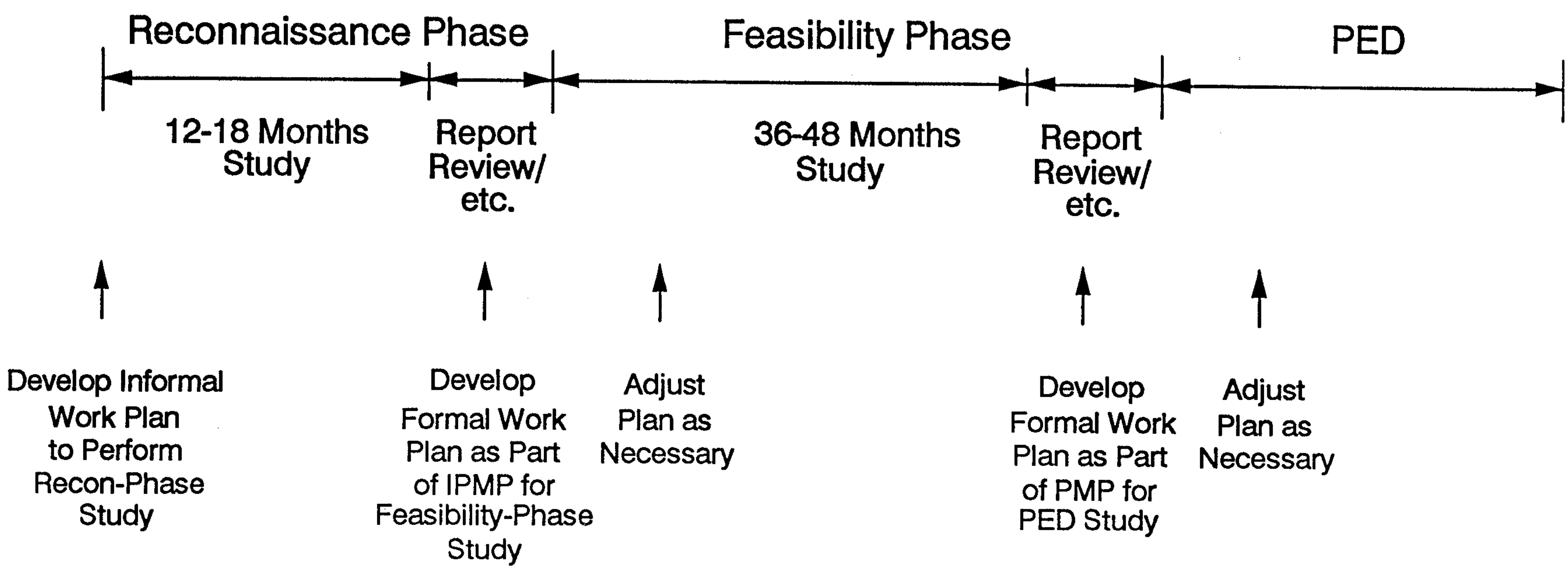
Report Format. The HEMP typically provides an annotated outline of the technical report or appendix of the hydrologic engineering analysis. This can significantly expedite the report documenting process and enables work on the final report to progress throughout the study.

ROLE OF HYDROLOGIC ENGINEERING MANAGEMENT PLANS

Overview. The HEMP provides a documented approach for the conduct of the hydrologic engineering study. The development process is iterative, with adjustments made after discussions with other disciplines and the study/project managers. After agreement is reach, the hydrologic engineer should consider the HEMP firm, much like a private consultant's proposal to perform a job. Outside factors beyond those that would be typically considered in formulating the HEMP can cause subsequent adjustments, but these should happen infrequently.

The purpose and applicability of HEMP's vary with the type of study being performed. Figure 1 shows a time-line schematic of the various milestones where an HEMP is applicable.

Hydrologic Engineering Management Plans Throughout Planning and Design Studies



Reconnaissance-phase Studies. An HEMP should be developed before the initiation of the reconnaissance-phase study for internal use and to negotiate the scope, cost, and schedule for the hydrologic engineering analyses with the study/project manager. The reconnaissance-phase hydrologic analyses must be of sufficient detail and reliability so that the results can be used as a basis for determining if there are projects with federal interests. In a typical study, one might expect about three months time to conduct the hydrologic engineering study using one or more persons full time.

When possible, existing conditions hydrologic engineering studies should be completed for without-project conditions. An array of likely candidate flood damage reduction measures should be investigated. (USACE, 1988)

A formal detailed HEMP defining the hydrologic engineering study requirements, costs, and schedules for the feasibility-phase study should be prepared as part of the Initial Project Management Plan (IPMP) required at the end of the reconnaissance-phase study. The HEMP may be included as an appendix, and/or portions of it included in the main portion of the IPMP. This step is presently omitted by many hydrologic engineering staffs and study/project managers. The agreed upon HEMP represents the proposal for the conduct of the hydrologic engineering analysis for the feasibility-phase study and for negotiations of in-kind services the local sponsor.

Feasibility-Phase Studies. The HEMP developed for the IPMP may be updated or developed in greater detail at the beginning of the feasibility-phase study. Normally the schedule and cost estimate presented for the IPMP should remain firm. A typical hydrologic engineering study for the feasibility phase may be two or more years involving one or more staff persons. This is highly variable depending on the complexity of the study and other factors.

The hydrologic engineering analyses are conducted to sufficient detail so that existing and future with- and without-project conditions analyses are completed and a recommended plan presented. The hydrologic engineering analyses involving flood hazard studies and project performances should be complete. Hydraulic design of features are performed in PED should be essentially complete and the results stable. Some refinements are required as the design of the selected plan proceeds through Preconstruction Engineering and Design (PED).

CASE EXAMPLE: CITY OF NAPA INTERIOR FLOOD HYDROLOGY STUDY

Background. The Hydrologic Engineering Center (HEC) is performing an interior flood hydrology study of the City of Napa, CA, for the Sacramento District Corps of Engineers. The district is considering a series of levees as a means of reducing the flood damage potential to the city caused by flooding of the Napa River which flows through the center of the town. The interior flooding that would result because of the levees must be addressed as part of the plan. The study is a Preconstruction Engineering and Design reaffirmation study.

The initial task was for HEC to develop a Hydrologic Engineering Management Plan for performing the interior flood hydrologic engineering analysis for the study area. The plan, or HEC's proposal was to be the basis for deciding if HEC would proceed with the technical study. The district funded HEC $5,000 to develop the HEMP. The final agreed upon HEMP is attached as an appendix.

Hydrologic Engineering Management Plan Development. The development of the HEMP for the Napa study was based on discussions with the district's technical and project management staff, review of available information including that from previous studies, review of the engineering manuals and other guidance (USACE, 1986, 1991, and 1992a), and a field reconnaissance of the study area.

The study and project managers, hydrologic engineers and economics technical staffs made presentations and met with the HEC staff to review the Napa study. Two subsequent meetings between HEC and the district's hydraulics staffs were held to scope the interior study and to determine the information the district would provide. Maps and previous reports were provided to HEC. A detailed field reconnaissance was conducted by HEC and a meeting held to review the study with a representative of the City of Napa engineering staff.

Key issues identified were the potential affect of San Pablo Bay tidal fluctuations on the exterior stages of the lower study area reaches, tie-back levees and associated closure of openings in the highly urban area of Napa Creek, definition of the flow patterns for the interior areas, and the analysis of the minimum facilities for the interior areas. The limited rainfall and streamgage records for the study area also presents problems. The district is to provide significant guidance, and where possible, data to address these issues. HEC has retained under contract the recently retired city engineer of the City of Napa to assist with specific aspects of the existing flow patterns and storm sewer system.

The hydrologic engineering analysis of the interior areas is to be performed using the HEC-Interior Flood Hydrology (HEC-IFH) program (USACE, 1992b). HEC will establish the with- and without-project conditions for the interior areas. Several size gravity outlets and pumping station capacities will be investigated.

The HEMP strategy and procedures were defined using an annotated outline format. Study cost estimates are based on the tasks and the assumption that a junior engineer will perform the analyses under the direction of a senior engineer. Cost estimates include actual engineers' salaries times a factor of 2.8 to account for overhead. The overhead includes secretary and reproduction expenses. The total HEC cost to perform the study is $65,000. This is based on the district providing HEC a substantial amount of precipitation, runoff, exterior stage, and storm sewer alignment data. The cost estimate to do the study is estimated to be more than $150,000 if performed entirely by HEC. A Gant chart style schedule was subsequently developed based on the district defined study milestones and major study tasks to be performed.

Present Status. HEC and the Sacramento District agreed upon the Hydrologic Engineering Management Plan as presented in the attached appendix. Funds have been provided to HEC and work has commenced on the project.

ACKNOWLEDGEMENTS

The author wishes to thank Harry Dotson, senior hydraulic engineer of the Planning Analysis Division, HEC, for his assistance. Mr. Dotson is the project engineer for the Napa study and was primarily responsible for development of the HEMP.

REFERENCES

1. USACE, 1988. Proceedings of a Seminar on Flood Damage Reduction Reconnaissance-phase Studies, Hydrologic Engineering Center.

2. USACE, 1991. Policy and Planning Guidance, ER 1105-2-100.

3. USACE, 1992a. Hydrologic Engineering Studies Design, EP 1110-2-6007.

4. USACE, 1992b. Hydrologic Engineering Center Interior Flood Hydrologic Package, (HEC-IFH), User's Manual.

5. WRDA, 1986. Water Resources Development Act of 1986.

APPENDIX

HYDROLOGIC ENGINEERING MANAGEMENT PLAN FOR ANALYSIS OF INTERIOR FLOOD DAMAGE REDUCTION MEASURES

NAPA, CALIFORNIA

INTRODUCTION

This Hydrologic Engineering Management Plan (HEMP) is developed for Sacramento District Corps of Engineers for the hydrologic engineering analysis of interior flood damage reduction measures for the City of Napa, CA. The study is a reaffirmation Preconstruction Engineering and Design (PED) investigation. The objective of the hydrologic engineering analysis is to determine: 1) the minimum outlet facility associated with the line-of-protection; 2) the existing and future stage-frequency relationships for the without project conditions; 3) the stage-frequency relationships for a range of gravity outlet and pumping station sizes and configurations for the interior areas; and 4) with the assistance of the district staff, a formulated set of viable flood damage reduction plans for each interior area.

The HEMP includes a proposed schedule, person-day, and cost estimate for the hydrologic engineering tasks that HEC would be responsible for completing. These tasks include those described in Sections, 5, 6, and 7, Minimum Facilities Analysis, Formulation and Comparison of Interior Flood Damage Reduction Measures and Technology Transfer. HEC will also be responsible for the portions of Section 4 which deal with the assessment of local flooding when the Napa River is below flood stage. A major HEC goal is to provide the district with the capability of applying HEC's Interior Flood Hydrology (HEC-IFH) program. The degree to which HEC is involved in the formulation process is negotiable. The district will provide stage-damage relationships and other data required to perform the expected annual damage computations for each plan. Cost estimates of the flood damage reduction measures and plans are also to be provided by the district. The district will be responsible for the tasks described as: Preliminary Investigations, Data Development and Assembly, and Evaluation of the Without Project Conditions for the Napa River. Some of the tasks described in this plan are required for the general hydrologic engineering investigations for the levee, flood wall, and channel improvement features of the Napa River Project. Accordingly, several of the tasks may have already been accomplished. Design requirements for conveyance systems, inlet and outlet works, and cost estimates for project components are not included in the Hydrologic Engineering Management Plan.

PRELIMINARY INVESTIGATIONS

This initial phase includes a literature review of previous reports, obtaining the available data and requesting additional information needed to perform the investigation.

Initial Preparation.

1) Confer with other disciplines involved in the study to determine the objectives, the hydrologic engineering information requirements of the study for other disciplines, study constraints, etc.

2) Discuss study type, scope, and objectives

3) Review available documents

   a) USGS reports
   b) Previous Corps work
   c) Local studies
   d) Other

4) Obtain historic and design discharges, discharge-frequency relationships, highwater marks, bridge designs, cross-sections, and other data.

   a) Local agencies
   b) State
   c) Federal (USGS, SCS, USBR, etc.)
   d) Railroads
   e) Industries
   f) Other

5) Scope major hydrologic engineering analysis activities

6) Prepare Hydrologic Engineering Management Plan

Obtain Study Area Maps.

1) County highway maps

2) USGS quads

3) Aerial photographs

Existing Storm Sewer Design and Configuration. The existing and any proposed storm sewer layout, discharge design capacities, and elevation of the inverts of the conveyance network is important for defining drainage areas, minimum facilities, and invert elevations of major conveyance to outlets, gravity outlet inverts, pumping station on-off elevations, and design criteria for inlet and outlet works.

1) Determine layout and design of existing systems - Usually obtained from local public works department or City Engineer.

2) Determine layout and design of potential future systems - Local drainage system enhancements that have been planned and designed by local interests should be accommodated.

3) Determine location of flow concentration at the line-of-protection where gravity outlets or pumps may be located and the layout of collector/conveyance systems adjacent to line-of-protection to concentrate flows at these locations where required.

Estimate Location of Cross Sections on Maps. (Flood Plain Contractions, Expansions, Bridges, etc). Determine mapping requirements (orthophoto) in conjunction with other disciplines.

1) Napa River from downstream of the project through the upper end of project.

2) Major ditches, channels, in the interior areas that will convey flood waters to the interior area outlets.

Field Reconnaissance. It is important for the hydrologic engineer to establish presence, a relationship with Napa area field office counterparts such as Director of Public Works, City Engineer, and other local, state, and federal agency staff people. These people can be key contacts throughout the study. Other field activities are described below.

1) Interview local agencies, and residents along the stream, review newspaper files, etc., for historic flood data (high water marks, frequency of road overtopping, direction of flow, land use changes, stream changes, etc.). Document names locations, and other data for future reference.

2) Finalize cross-section locations/mapping requirements.

3) Determine initial estimate of "n" values for later use in water surface profile computations.

4) Take photographs or slides of outlet inverts and ditches that will be cut off by the line-of-protection, bridges, construction, hydraulic structures, and flood plain channels and overbank areas at cross-section locations.

Survey Request. Write survey request for mapping requirements and/or cross-sections and high water marks for Napa River and interior area conveyance systems.

DATA/INFORMATION ASSEMBLY

General. Data/information assembly is required for the analysis of the interior area. It includes data for both the interior and exterior (Napa River) areas. The information is applicable for any analytical method, but is specifically targeted for application of the HEC-IFH computer program, and assumes that the analyses will be conducted using both a continuous record and hypothetical event approach. An assessment of the HEC-IFH utility as an appropriate model should be made as early as possible.

The continuous record analysis is the most straight forward approach because of the tidal affects on Napa River stages at interior outlet locations and the need to investigate the coincidence of exterior stages on gravity outlet flows and pumping discharges. Potential problems with the continuous analysis approach is lack of data and definition of the interior runoff system. The hypothetical event analysis would enable some refinement of the interior runoff system, but presents problems with the tidal affects and coincident interior and exterior storm analyses.

1) Define interior areas to be studied. Consideration must be given to alignment of the line-of-protection, minimum facility requirements, runoff topology, topography of local ponding areas, present storm sewer systems and potential for additional storm water collector/conveyance systems.

2) Delineate interior subbasins for each area considering locations needed for stage-frequency relationships and affects of storm sewer system.

3) Select computation time interval (Δt) for this and subsequent analyses. Must define adequately the peak discharge of hydrographs at gages, normally three to four points on the rising limb of the unit hydrograph. Routing reach travel times should also be considered, as should the location and types of flood damage reduction measures to be analyzed. The importance of using a small time interval is dependant on the size of the available ponding area and the associated flow attenuation at the outlets.

Rainfall Data. This activity includes the assembly of historical storm records and hypothetical frequency event data.

1) Obtain and verify historic rainfall records of nearby recording and nonrecording raingages. Determine weighting of gages for each interior subbasin.

2) Develop hypothetical frequency storm depth-frequency-duration relationships for general rain and local storms.

3) Determine the characteristics of the SPS

Runoff and Channel Routing Data. Interior runoff hydrographs may be computed using the HEC-IFH program or imported from an external HEC-DSS file generated by a different program. For example the HEC-1 program may be used to perform the runoff and channel routing of a complex system (more than two subbasins). Externally determined hypothetical or period-of-record runoff hydrographs may be imported into the HEC-IFH program and used in the computations.

1) Determine interior subbasin drainage areas, unit hydrograph methods and variables.

   NOTE: HEC-IFH does not use kinematic wave, but HEC-1 can be used to compute hypothetical runoff hydrographs using kinematic wave and imported into HEC-IFH. The use of the kinematic wave approach is not possible for the continuous record analysis unless the runoff sequences are generated by another program (other than HEC-1) and imported to HEC-IFH. An alternative would be to use an HEC-1 model with kinematic wave and one-inch of runoff to generate unit hydrographs for each interior area. These unit hydrographs could be entered into HEC-IFH and used for hypothetical event and/or continuous simulation analysis.

2) Determine loss rate methods and values. These include monthly rates for continuous record analysis and event variables for hypothetical event analyses.

3) Determine base flow. Continuous simulation analysis can incorporate monthly rates, hypothetical event analysis can incorporate an initial rate and recession variables.

4) Determine streamflow routing method and parameters.

Interior Ponding Area Data.

1) Develop elevation-area relationships for each ponding area adjacent to line-of-protection. (User should specify 15-20 points to define the relationship.) HEC-IFH will automatically generate the storage values. The minimum value should be at or below the lowest invert elevation to be analyzed for that ponding area. The maximum value should be above the highest stage anticipated in the analysis. (The program will not extrapolate above or below these maximum or minimum elevations.)

2) If applicable, develop the discharge-elevation relationship for the ditch that connects the ponding area to the gravity outlet and/or pump. (Required only if the ponding area is not adjacent to the outlets at the line-of-protection.)

Exterior Stage Data. These data must include continuous stage hydrographs considering the historic patterns of Napa River discharge values coincident with any tidal affects on the exterior stages at the outlet locations of each interior area to be studied. The hypothetical storm analysis would likely involve analysis assuming storms centered over both the interior area and Napa River drainage basin. There is no apparent straight-forward manner to account for tidal affects with the hypothetical approach, although a coincidence weighting method, based on percent time (probability) of the stages of the San Pablo Bay associated with a series of hypothetical flood events occurring for each stage, may be appropriate.

1) Obtain the period-of-record for elevations of the San Pablo Bay at the mouth of the Napa River. The time interval must be sufficiently small to capture tidal affects (6-hour stages.)

2) Obtain the period-of-record of the discharge values of the Napa River at appropriate gage locations. Determine if adjustments to the discharge values are required for the outlet locations of each interior area to be analyzed.

3) Develop a family of rating curves at the outlet locations based on various San Pablo Bay elevations and Napa River discharges. The analysis requires running a series of water surface profiles for various Bay elevations.

Gravity Outlets. Determine typical gravity outlet information and operation criteria.

1) Determine appropriate gravity outlet locations based on local conveyance systems, storm sewer system layouts and invert elevations, and ponding area locations.

2) Define typical gravity outlet data: lengths from levee or flood wall dimensions, etc.; inverts/slope from storm sewer and ponding area elevations; box or circular; concrete or MP, etc.; entrance and exit configurations.

3) Define gravity outlet operation criteria: head differential for closing, any gate closure requirements.

4) Develop cost estimates for various gravity outlet types and sizes.

Pumping Stations. Determine typical pumping station data and operation criteria.

1) Define criteria for number of pumps including base flow pump, back-up units, etc.

2) Define pump characteristics: requirements for on\off elevation determination (may vary monthly in HEC-IFH); head-capacity-efficiency relationships.

3) Develop cost estimates for various pumping capacities.

Auxiliary Flow Data. Auxiliary flow includes auxiliary inflow to the interior subbasin, diversions out of the system, seepage inflow from the exterior (Napa River) to the interior area, and overflow out of the interior area.

1) Determine head versus seepage relationships for each interior area.

2) Determine diversions and diversion rates out of the system, and auxiliary inflow hydrographs, if appropriate.

3) Determine overflow potential and if required, the pond elevation-overflow discharge relationship.

Water Surface Profile Data. Water surface profile analyses are used to determine water surface elevations and rating relationships for the Napa River (and perhaps major conveyance channels to the interior outlets), flood damage reaches, and Modified Puls channel routing criteria.

1) Cross sections (tabulate data from each section). Make cross sections perpendicular to flow. Sections should be typical of reaches upstream and downstream of cross-section. Develop effective flow areas.

2) If modified Puls routing criteria is to be determined from water surface profile analyses, the entire section must be used (for storage) with high "n" values in the non-effective flow areas. Refine "n" values from field reconnaissance and from analytical calculation and/or comparison with "n" values determined analytically from other similar streams.

3) Bridge and culvert computations - estimate where floods evaluated will reach on each bridge and select either: (a) normal routine or (b) special routine

Stage-Damage Relationships. Representative stage-damage relationships for the interior areas at runoff concentration points (proposed outlet locations) are required for identification of interior plans which maximize net flood damage reduction benefits.

WITHOUT PROJECT CONDITIONS ANALYSIS FOR MINIMUM FACILITY EVALUATION

General. The without project analysis involves determination of conditions both without the line-of-protection and with the line-of-protection in place. Stage-frequency relationships for these conditions are needed to select a minimum facility. The without project condition used to formulate and evaluate the interior flood damage reduction measures will assume the minimum facility in place and therefore, is described in Section 5, Minimum Facility Analysis. The procedure described assume that the HEC-IFH program will be used to determine interior area local hypothetical storm event runoff hydrographs.

Napa River Flooding Without Line-of-Protection. This information should be available from the line-of-protection design analysis. It is used to determine Napa River flood elevations over the interior areas and to compare the elevations with those caused by local flooding when the Napa River is below flood stage. (See paragraph C., below.) A series of stage-frequency relationships for the 50-, 20-, 10-, 4-, 2-, 1-, .5-, and .2- percent chance exceedance events should be developed and provided for each interior area.

Local Runoff Flooding Without Line-of-Protection. This analysis is for local flooding without the line-of-protection in place, assuming the present storm sewer system in place and the Napa River is at or below flood stage. It is the target condition for the minimum outlet facility analysis. Stage-frequency relationships including the 50-, 20-, 10-, 4-, 2-, 1-, .5-, and .2- percent chance exceedance events are developed for each interior area as described below.

1) Define precipitation and runoff data sets for computing hypothetical storm runoff hydrographs.

   a) Enter local hypothetical storm depth-duration-frequency data for defining PRECIP module for Hypothetical Event Analysis (HEA).

   b) Enter appropriate rainfall-runoff and routing parameters, if any, to define RUNOFF module.

2) Develop normal depth rating for the interior runoff approach to the Napa River. Napa River is assumed to be low and therefore, there will be no backwater effect.

3) Define a plan using the precipitation and runoff data and exercise the HEC-IFH program to compute interior runoff hydrographs. - The program computes the interior area runoff and routes the runoff to the area outlet for each hypothetical event. Peak flow is displayed for each hypothetical storm frequency.

4) Determine interior stage-frequency relationship. - The peak flow for each hypothetical storm runoff event will be used with the normal depth rating to determine the maximum interior elevation for each event and the stage-frequency curve will be derived graphically.

Local Runoff Flooding, With Line-of-Protection and No Outlets. This analysis assumes the line-of-protection is in place and the local conveyance systems to the Napa River are blocked by the line-of-protection. It becomes the without condition for the minimum facility analysis and represents an upper bound for the stage-frequency relationship with the minimum facility in place. Stage-frequency relationships including the 50-, 20-, 10-, 4-, 2-, 1-, .5-, and .2- percent chance exceedance interior runoff events are developed for each interior area. The analysis is the same as described for the without line-of-protection condition, except the runoff will now pond behind the line-of-protection.

1) Enter appropriate elevation-area relationship and interior ditch rating, if required, to define the ponding area adjacent to the line-of-protection POND module.

2) Define a new plan using HEA and exercise the HEC-IFH program to compute interior stage-frequency relationship. - The program computes the interior area runoff and routes the runoff to the ponding area where it is stored assuming no outlet to the Napa River. The program displays the maximum interior elevation for each hypothetical event and a graphical fit stage-frequency curve.

Assess Future Without Project Conditions Impacts. Assess future conditions affects on Napa River interior area local runoff flooding. The effect may well be minimal. Where hydrologic and/or hydraulic conditions are expected to significantly change over the project life, these changes must be incorporated into the H&H analysis. Urbanization effects on watershed runoff are the usual future conditions analyzed. The analysis will derive a set of future condition stage-frequency relationships for the conditions described in paragraphs B, C, and D, above.

1) Identify Future Development. From future land use planning information obtained during the preliminary investigation phase, identify areas of future urbanization or intensification of existing urbanization.

   a) Types of land use (residential, commercial, industrial. etc.)

   b) Storm drainage requirements of the community (storm sewer design frequency, on site detention, etc.)

   c) Other considerations and information.

2) Select future years in which to determine project hydrology.

   a) At start of project operation (existing conditions may be appropriate).

   b) At some year during the project life (often the same year as whatever land use planning information is available).

3) Adjust Model Hydrology Parameters for all Areas Affected by Future Land Use Changes.

   a) Unit hydrograph coefficients reflecting decreased time-to-peak and decreased storage.

   b) Loss rate coefficients reflecting increased imperviousness and soil characteristics changes.

   c) Routing coefficients reflecting decreased travel times through the watersheds hydraulic system.

4) Operate hydrologic models, including HEC-IFH using local storm HEA, and determine revised discharge-frequency and/or stage-frequency relationships throughout the watershed for future without project conditions.

MINIMUM FACILITY ANALYSIS - WITHOUT PROJECT CONDITIONS FOR EVALUATING INTERIOR MEASURES

General. The minimum facility of the individual interior areas will be justified as part of the line-of-protection. The stage-frequency relationships for the with minimum facility in place condition becomes the without condition for evaluating potential interior flood damage reduction measures. The residual damage with the minimum facility in place is thus the target for damage reduction of implemented interior flood damage reduction measures. The minimum facility should provide interior flood relief such that during low exterior stages (gravity conditions) the local interior area runoff will pass the design storm sewer outflow without an increase in elevation over natural or without line-of-protection conditions. Flood stages with the minimum facility in place should not be significantly higher than stages for less frequent flood events assuming it can be established that these less frequent flood events have and will occur when the Napa River is below pre-project flood stage.

Evaluate Range of Minimum Facilities. The minimum facility will normally include gravity outlets but may include pumps if the coincidence of flooding between the interior and exterior is high. For example, the Napa River is high enough to block gravity outlets, but is below pre-project flood stage and flooding occurs in the interior from local runoff. The sequence will be to evaluate a series of gravity outlets then pumps, if required. The physical characteristics of the gravity outlets should be established prior to the analysis and refined as the analysis proceeds. The analysis should be performed for the range of hypothetical frequency events.

1) Analyze series of gravity outlet capacities and configurations using local storm hypothetical event analysis and assuming unblocked conditions. The analysis is the same as that for the local flooding with the line-of-protection in place (Section 4.D.), except gravity outlets through the line-of-protection are incorporated.

   a) Define 5 or 6 gravity outlet configurations (modules) of increasing capacity. Outlet sizes should encompass the largest storm sewer size or ditch capacity at the line-of-protection.

   b) Define a new plan for each gravity outlet capacity to be evaluated and, using local storm HEA, exercise the HEC-IFH program and determine the interior stage-frequency for each outlet.

2) Compare stage-frequency relationships of gravity outlets with storm sewer design event and with the local area flooding stage-frequency relationships with (no outlet) and without the line-of-protection in place.

3) Select minimum facility. - The minimum facility is selected to assure that expected flooding and associated damages from the local, interior area with the line-of-protection in place are no worse than flooding from the local area (not including the Napa River) and associated damages were before the line-of-protection was in place.

4) Perform analysis for all interior areas and for expected future conditions. The expected future condition hydrologic parameters are incorporated and the analysis is repeated using the selected minimum facility. If the selected facility is not efficient to assure that local flooding with the line-of-protection and the minimum facility in place will not be worse than what would be expected in the future without the project, upgrade the selected minimum facility accordingly.

Develop Without Project Condition Stage-Frequency Relationship with the Minimum Facility in Place. After the minimum facility is selected, it is evaluated using continuous simulation analysis and general rain hypothetical event analysis. The results of the analysis can be used to test the effectiveness of the minimum facility gravity outlet by assessing local runoff flooding that occurs during blocked conditions. The results of the analysis establishes the base plan or without condition stage-frequency relationships for evaluating additional interior flood damage reduction measures as described in Section 6.

1) Define Continuous Simulation Analysis (CSA) plan using the HEC-IFH program that incorporates period-of-record interior area rainfall, existing condition runoff characteristics, existing interior ponding area, the selected minimum facility, seepage, and period-of-record exterior stages at the interior area outlet.

   a) Define PRECIP module for CSA. - Historical, period-of-record rainfall data for representative recording and non-recording gages are used. The data are generally retrieved from NWS magnetic tapes or from available CD ROM and stored in an HEC-DSS file where it can be imported directly into the HEC-IFH program. Gage weightings are specified for determining basin average precipitation.

   b) Define rainfall, runoff, pond and outlet parameters. - Existing condition rainfall-runoff and routing (RUNOFF module) parameters, ponding area characteristics (POND module), and the minimum facility are defined for CSA in the same manner as previously described for HEA.

   c) Define exterior stage (EXSTAGE module) data for CSA. - Historical, period-of-record discharge or stage hydrographs for main river gages are obtained from available electronic media and stored in an HEC-DSS file for direct importing to the HEC-IFH program. Napa River period-of-record stage hydrographs at each interior outlet location are determined by one of the following methods each of which can be accomplished using the HEC-IFH program.

      - Exterior stage from historical, period-of-record stage hydrographs. Typically the gage data (index location) will need to be transferred to interior area outlets (primary and secondary) locations by incorporating transfer functions that relate index stage to primary and secondary outlet locations. These transfer relationships are developed from water surface profiles and are used by the HEC-IFH program to determine the exterior stage at the outlets for each time period during pond routing computations.

      - Exterior stage from historical period-of-record discharge hydrographs. Typically, discharge hydrographs are more readily available than stage hydrographs. If discharge hydrographs are employed, a rating curve is incorporated which is used to convert flow to stage at the index locations. The stages are transferred to primary and secondary outlet location as described above, if required.

      - Exterior stage from computed period-of-record discharge. If recorded stages or flow are not available, discharge hydrographs can be computed from rainfall-runoff analysis. Flow is converted to stage and stage transferred to the outlet locations as described above, if required.

- San Pablo Bay impact on exterior stage for CSA. If it is determined that tidal fluctuations in the San Pablo Bay influence the stages at the interior area outlet locations, a family of rating curves for each interior outlet that gives Napa River stage based on Napa River flow and stage in San Pablo Bay is required. These relationships are developed by determining water surface profiles for various stages in the bay. Analysis period San Pablo Bay stages are also required and could be obtained from historical data or generated based on known tidal cycles. These data are used by the HEC-IFH program to determine the appropriate exterior stage at the gravity outlet for each time period in the analysis.

d) Define seepage (AUXFLOW module) data for seepage inflow from the Napa River to the interior ponding area, if appropriate. A relationship between differential head (the exterior stage minus the interior stage) and seepage inflow is defined and incorporated. No seepage occurs when the interior stage is equal to or greater than the exterior stage. The data is developed based on field measurements or empirical information.

2) Exercise the HEC-IFH program using the developed CSA data modules and specify either a partial duration or annual series frequency analysis. The results will include a graphical fit interior stage-frequency relationship.

3) Examine the periods of local flooding (Napa River below pre-project flood level) and determine the extent of local flooding caused by blocked gravity outlet conditions. If flooding resulting from this condition is considered worse than pre-project local flooding, the minimum facility may require the addition of a pump to alleviate induced flooding. In this case, pumping capacity would need to be evaluated using the CSA plan data. (See Section 6 for evaluating pumping capacity).

4) Define a new general rain HEA plan using the HEC-IFH program that incorporates precipitation depth-duration-frequency data for general rain events occurring over the Napa River watershed as well as the interior area. Exterior stages will be computed from rainfall-runoff analysis and an appropriate stage-discharge rating for the Napa River at the interior area outlet. San Pablo Bay tidal effects on hypothetical exterior stages will be incorporated using coincident frequency analysis, if required.

   a) Define a new precipitation data set (PRECIP module) using HEA by assembling general rain depth-duration-frequency storm data for the 50-, 20-, 10-, 4-, 2-, 1-, .5-, and .2- percent chance exceedance events occurring over the local interior areas as well as over the Napa River watershed.

   b) Define rainfall, runoff, pond, outlet, and seepage parameters. - Existing condition rainfall-runoff and routing (RUNOFF module) parameters, ponding area characteristics (POND module), the minimum facility, and seepage are defined in the same manner as previously described.

c) Exterior stages for each hypothetical event are computed discharge hydrographs and a specified rating. The discharge hydrographs are computed from rainfall-runoff analysis as described above.

d) San Pablo Bay impact on exterior stage for general rain HEA. If it is determined that tidal fluctuations in the San Pablo Bay influence the stages at the interior area outlet locations, it may be appropriate to develop bay elevation-duration relationship and use coincident frequency analysis to account for the bay effect on the stage-frequency curve.

5) Exercise the HEC-IFH program using the developed HEA data modules. The results will include a graphical fit interior stage-frequency relationship. This curve will help to determine if rare combinations of events are being captured in the continuous simulation analysis and will help shape the final without project condition stage-frequency relationship.

6) Final stage-frequency relationships. Make appropriate adjustments to the CSA stage-frequency relationship based on the results of the without line-of-protection and with line-of-protection and no outlet plans developed from local storm HEA and the results from the general rain HEA.

7) Future without project condition stage-frequency relationships with the minimum facility in place. Repeat above CSA and HEA incorporating expected future condition hydrologic parameters and develop future condition stage-frequency relationships.

FORMULATION AND COMPARISON OF INTERIOR FLOOD DAMAGE REDUCTION PLANS

General. The objective of this task is to formulate a set of flood damage reduction plans for each interior area. The condition with the line-of-protection and the selected minimum gravity outlet in place becomes the without project condition for evaluating additional features such as additional gravity outlets, pumping stations, additional ponding area storage, and nonstructural measures. The first step is to find the economic optimal size and configuration for additional gravity outlet capacity with the minimum facility in place. The second step is to identify the economic optimal pump capacity, assuming that the minimum facility and the optimal gravity outlets are in place. The third step is to explore trade-offs of pumping capacity vs. ponding area storage and would include evaluation of nonstructural measures to increase non-damaging ponding area storage. Finally, the conceptual feasibility of other flood damage reduction actions such as flood warning-preparedness and institutional arrangements would be evaluated. The district and HEC will work closely together in the plan formulation and comparison process. The following paragraphs describe the procedures in more detail and how both the continuous simulation and the hypothetical event analyses can be applied.

Determine Economic Optimal Gravity Outlet Capacity

1) Stage-Frequency Relationships.

   a) Define new plans for evaluating gravity outlets using data previously defined for the CSA with the minimum facility in place. Existing condition rainfall (PRECIP module), runoff and routing (RUNOFF module) parameters, ponding area characteristics (POND module), minimum facility (GRAVITY module), and seepage (AUXFLOW module) are the same as used for the CSA analysis of the selected minimum facility.

   b) Assemble outlet characteristics for several standard size outlets and develop composite rating curves for each using the HEC-IFH program

   c) Develop 5 or 6 gravity outlet configurations (modules) with one or more gravity outlets in addition to the minimum facility outlet, each module representing and incremental increase in total outlet capacity.

   d) Exercise the HEC-IFH program and using CSA, develop several plans which incorporate the gravity outlet modules, described above, and determine interior stage-frequency relationships for each plan.

   e) Define new plans and using HEA, assemble general rain depth-duration-frequency storm data for the 50-, 20-, 10-, 4-, 2-, 1-, .5-, and .2- percent chance exceedance events occurring over the local interior areas as well as over the Napa River watershed and determine the interior stage-frequency relationships for each plan. The analysis is similar to that described for the general rain HEA of the minimum facility but will include analysis of several plans incorporating the additional gravity outlet capacities defined in c., above. The relationships will help determine if rare combinations of events are being captured in the continuous simulation analysis. These relationships will also help establish the upper end of the graphical curve determined in d., above.

   f) Define additional plans using HEA and local storm depth-duration-frequency data for the 50-, 20-, 10-, 4-, 2-, 1-, .5-, and .2- percent chance exceedance events occurring over the interior area with unblocked conditions on the Napa River. Determine the interior stage-frequency relationships for each plan. This relationship will help to determine if rare combinations of events are being captured in the continuous simulation analysis and may help to shape the final stage-frequency relationships.

   g) After examining the results of the continuous and hypothetical event analyses, adopt a final stage-frequency relationship for each gravity outlet plan.

   h) Develop future condition stage-frequency relationships be repeating the described steps using expected future hydrologic condition data, if appropriate.

2) Determine equivalent expected annual damages (EAD) for each gravity outlet plan.

   a) The district will provide cost estimates of various sized gravity outlets and stage-damage relationships by damage category for existing and potential future conditions.

   b) EAD for each plan will be determined using the developed stage-frequency relationships, the stage-damage relationships, and HEC's EAD program.

   c) A plan comparison array including residual equivalent EAD, expected annual inundation reduction benefits, average annual costs, and net benefits will be developed identifying the economic optimal plan. This plan will most likely become the base plan for evaluating additional measures.

<u>Determine Economic Optimal Pumping Capacity</u>

1) General - If the analysis for determining the economic optimal gravity outlet indicates that gravity outlets are very effective (considerable peak runoff attenuation from ponding and little coincidence between interior runoff and high exterior stages) there would be little residual flood damages with the selected outlet in place. If gravity outlets are shown to be ineffective and residual damages are significant, pumps may be justified. The same steps described for evaluating additional gravity outlet capacity are appropriate for identifying the economic optimal pumping capacity. Some differences in the analysis are described below.

2) Base condition - The base condition for evaluating pumping capacity is with the minimum facility and, most likely, the economic optimal gravity outlet configuration in place. Several plans are evaluated against the base plan, each with an incremental increase in pumping capacity.

3) Pump operation criteria - Pump on and off elevations must be determines so that the pumps come on to effectively reduce damaging stages and turn off when stages drop below damaging levels. However, pumps should not cycle on and off over very short periods of time. Therefore, on elevations are usually set below flood stage and off elevations are usually set 1 to 2 feet below on elevations. On and off elevations can also vary by season (monthly) if appropriate. Two or more pump units make up a pumping plant or station. Several units that can be used for backup and which can be operated in phases to step up total capacity usually prove to be more effective than a few large capacity pumps.

4) Type of events and analyses - CSA, general storm HEA, and local storm HEA with blocked gravity conditions would be performed to derive final existing and future condition stage-frequency relationships, as described above, for the gravity outlet plans.

Evaluation of Increased Storage Capacity. It is prudent to investigate the trade-offs between pumping capacity and ponding area storage capacity. Pumps are expensive and an increase in storage capacity will typically allow reduction in required pumping capacity. There are several measures that can be evaluated, including increasing the physical size of the ponding area and non-structural actions that will reduce the damage for a given ponding stage.

1) Increasing the size of ponding areas - The potential for excavating larger ponding areas should be explored, if physically possible. The sensitivity of ponding area size vs. pumping capacity can be readily determined using the HEC-IFH program. The plan with the identified economic optimal gravity outlet and pumping station would be the base plan for determining if excavation is feasible.

2) Nonstructural measures - Temporary evacuation, relocation, flood proofing, and other non-structural measures that reduce susceptibility to damage (and increase available storage) should be evaluated. Residual damages for evaluated plans would be revised based on new stage-damage relationships resulting from implementing the non-structural measures.

Final Plan Selection. Other social, institutional, and environmental issues, including the management of future development, and flood warning and preparedness programs, would also need to be evaluated in the final plan selection for each interior area. HEC will assist the district in this evaluation, if desired.

TECHNOLOGY TRANSFER

Study Report. A study report that documents the Napa River interior flood analysis will be prepared. The text of the report will generally follow the topics in Sections 4, 5, and 6 of this plan, and a discussion of the results, including tables and figures.

HEC Workshop. A one or two day workshop will be conducted at HEC for district staff covering the Napa River interior flood analysis using the HEC-IFH, and EAD programs. It is intended that materials developed for this workshop will be used in future HEC PROSPECT courses on interior flood hydrology.

PROPOSAL FOR HEC ASSISTANCE TO THE SACRAMENTO DISTRICT FOR ANALYSIS OF INTERIOR FLOOD DAMAGE REDUCTION MEASURES NAPA RIVER, CA

Resource Requirements.

Task Description	GS-13 Person-Days	GS-11 Person-Days
1. Preliminary Investigation Assistance	2	2
2. Data Assemble Assistance	3	4
3. Without Project Analysis	5	10
4. Minimum Facility Analysis	5	15
5. Analysis of Flood Damage Reduction Measures		
a. Stage-frequency for gravity outlets	3	8
b. Stage-frequency for pumping station(s)	3	8
c. Formulation of alternative plans	5	20
d. Plan comparison and evaluation	3	3
6. Study Documentation and Technology Transfer	10	10
7. Coordination/Meetings with District Office	5	5
TOTAL	44	85

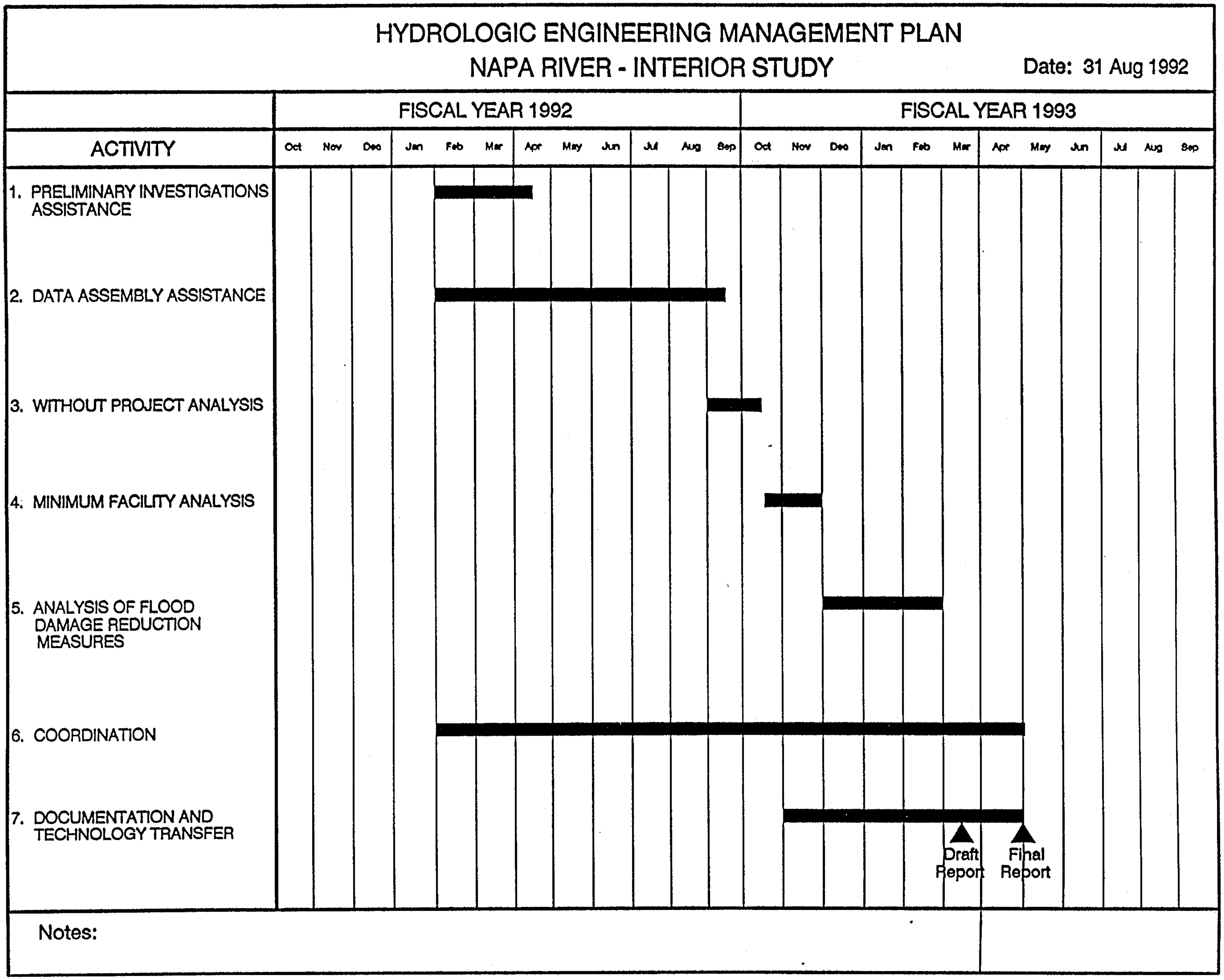
Estimated total cost at $600.00/day for GS-13 and
$450.00/day for GS-11 = $64,650.00

Use $65,000.00

(Note: Cost includes secretary, reproduction, etc.)

Schedule of Work.

(See attached schedule)


HYDROLOGIC ENGINEERING MANAGEMENT PLAN
NAPA RIVER - INTERIOR STUDY
Date: 31 Aug 1992
FISCAL YEAR 1992
FISCAL YEAR 1993
ACTIVITY
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep
1. PRELIMINARY INVESTIGATIONS ASSISTANCE
2. DATA ASSEMBLY ASSISTANCE
3. WITHOUT PROJECT ANALYSIS
4. MINIMUM FACILITY ANALYSIS
5. ANALYSIS OF FLOOD DAMAGE REDUCTION MEASURES
6. COORDINATION
7. DOCUMENTATION AND TECHNOLOGY TRANSFER
Draft Report
Final Report
Notes:

METHODOLOGY NEEDED IN THE DEVELOPMENT OF AN ECONOMIC MANAGEMENT PLAN FOR AN URBAN FLOOD CONTROL FEASIBILITY STUDY

by

Rayford E. Wilbanks[1]

PURPOSE

The days of conducting and managing studies/projects without a detailed defined scope, estimated study cost, and specific schedule have passed. Limited sponsor and Federal study funds and increased demands on a declining work force have fostered the necessity for detailed management plans that can be used to control Civil Works projects and studies. These plans are referred to as Initial Project Management Plans (IPMP) for feasibility phase studies and Project Management Plans (PMP) for postfeasibility studies and construction. The following documents are the main guidance requiring development of IPMP's:

a. ER 1105-2-100 (Planning Guidance).

b. Memorandum, CECW-P, Oct 88.

c. ER 5-2-1 (Project Management Regulation).

d. ER 5-7-1 (FR) (Project Management Guidance).

An Economic Management Plan (EMP) is an essential part of an IPMP. The purpose of an EMP for a feasibility study is to document work requirements and level of detail that will be necessary to measure the beneficial contributions to National Economic Development (NED) associated with flood hazard reduction features of water resource development plans. The EMP forms the basis for estimating economic study cost, schedule, and responsibilities. An EMP that has documented the alternatives to be evaluated and has clearly defined detailed work tasks will establish the basis for changes, help preclude review problems, and serve as a management control for feasibility phase studies.

Economic studies required may include economic base studies, institutional studies, impact assessment, financial analysis, ability-to-pay analysis, risk and uncertainty analysis, cost analysis, etc. To develop an appropriate EMP, the economist must identify and address the proper items/issues and studies required. Furthermore, the study/project manager and others must know what questions to ask when reviewing the EMP. Frequently, the lack of necessary detail in an EMP and the corresponding need for additional studies and funds during the feasibility phase occur because the critical relevant questions were not asked

[1]Regional Economist, Economic and Social Analysis Branch (CELMK-PD-E), Vicksburg District, Vicksburg, MS.

during development and review of the EMP. If the most significant questions are raised and addressed, then an EMP will be developed that is comprehensive in scope, has sufficient information to describe study tasks, and defines the level of detail and schedule necessary for economic studies. In developing and reviewing an EMP the main questions to ask are the traditional WHAT?, WHY?, WHO?, WHEN?, and HOW? Given the scope of study and potential alternatives to be evaluated, the following questions may be used as a guide in developing the tasks necessary for economic studies:

a. What specific economic evaluations are required?

b. What tasks are required for each economic study?

c. Why is the task necessary?

d. Who will accomplish each task?

e. When should the task be accomplished?

f. How critical is the task to the economic analysis?

g. How sensitive is the information needed for the task?

h. What methods should be used to accomplish the task?

i. What information is required to accomplish each task?

j. What information is available, and can it be used?

k. What information will need to be collected or derived?

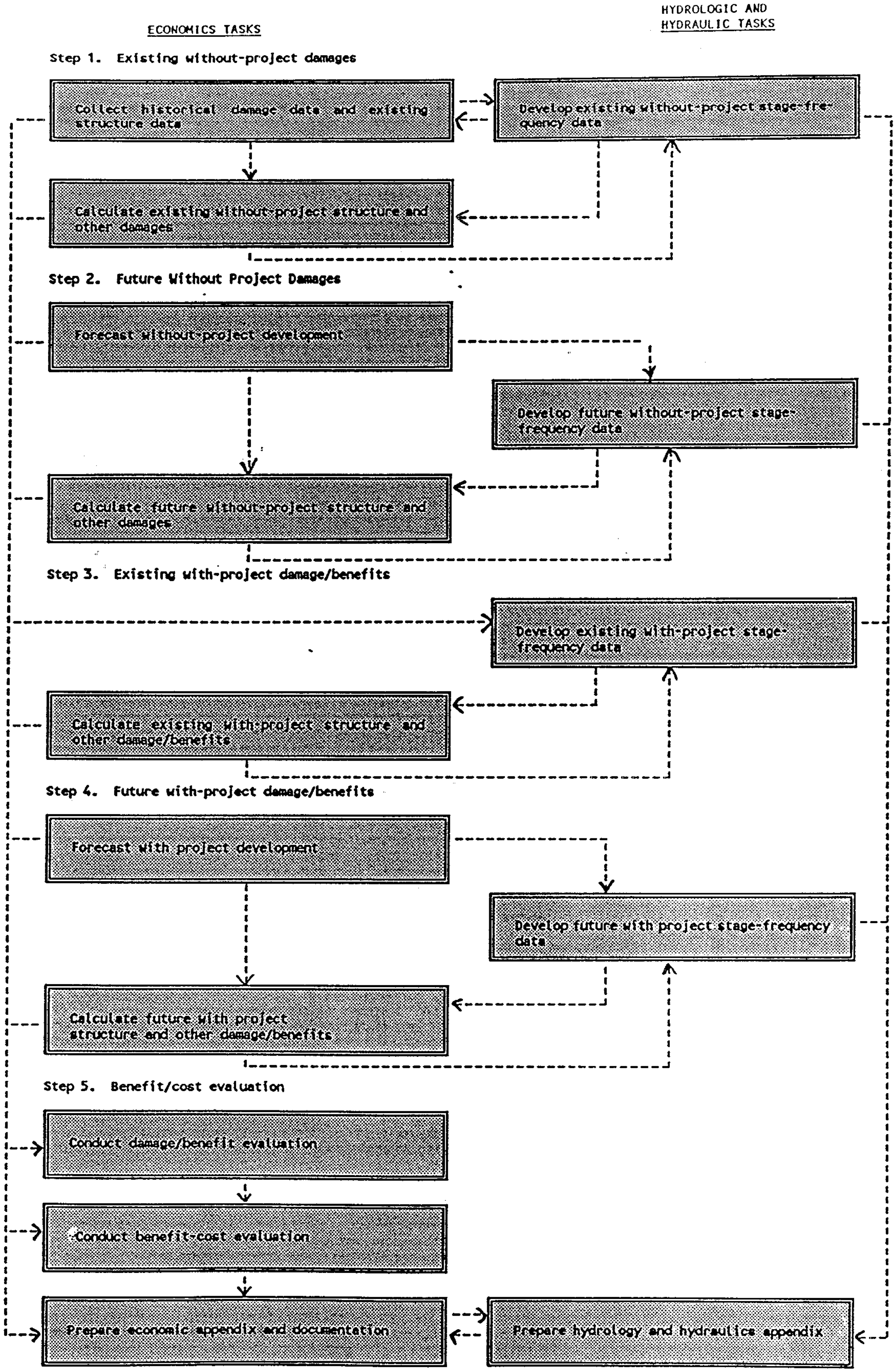
l. How much time and money should be devoted to each task?

STUDY TEAM COMMUNICATION

Communication among the study team members is a critical ingredient in the study process. Communication is needed to thoroughly define the existing flood problem and accurately formulate and correctly evaluate alternate flood reduction solutions. The economist must communicate and interact with all study team members throughout the study to acquire necessary data and knowledge to conduct economic studies. Constant effective communication among all disciplines is not only important, but necessary for each to successfully accomplish his/her individual tasks and mesh these into the overall study process. The study/project manager has an important leadership role in developing, facilitating, and maintaining communication among the study team members. The study/project manager must provide team members with appropriate guidance on such items as study scope, issues, and general study framework. As a group, the study team must decide on more specific items such as the without-project conditions, deadlines for study elements, alternatives to be evaluated, lessons learned from reconnaissance studies, etc.

The most critical communication is among the economist, hydrologist, and hydraulic engineer. Communication among these disciplines is key in conducting an urban flood control study. Tasks required among these disciplines can be conducted in chronological order in five steps. The following flowchart is presented to illustrate the interrelationships among these disciplines:

FLOWCHART OF ECONOMIC TASKS AND RELATIONSHIP TO HYDROLOGIC AND HYDRAULIC TASKS IN AN URBAN FLOOD CONTROL EVALUATION



The number of economic tasks necessary in a flood control evaluation of a typical urban area depends on the complexity of the evaluation and level of detail required. Following is a list of economic tasks that should be considered when developing an EMP for a typical urban flood control feasibility study. Task descriptions for each activity are given, followed by a brief explanation of the methodology to accomplish the task. Three examples are also given to illustrate the appropriate questions and terminology for the development of the EMP. The tasks and analysis methodology presented are not intended to be all-inclusive because other tasks and methods of analysis exist. The intent of this list is to give the economist, study/project manager, and others a guide and terminology to use in developing and reviewing an EMP. Tasks required for economic studies are presented under the following six topics:

I. Identification of Study Scope and Objectives

II. Economic Data Collection and Analysis of Existing Conditions

III. Future Land Use Without and With Project

IV. Other Damage/Benefit Categories

V. Development of the PMP

VI. Preparation of Economic Appendix

TASK I - IDENTIFICATION OF STUDY SCOPE AND OBJECTIVES

The need for and communication with the interdisciplinary planning team are of utmost importance in identifying the study scope and objectives. The flood reduction alternatives to be evaluated should be listed in as much detail as possible. The following information should be gathered and used by the planning team to develop study objectives and appropriate alternatives to address those objectives.

<u>Gather Historical Flood Damage Information</u>

Published and other sources (reconnaissance studies, postflood reports, Federal Emergency Management Agency (FEMA) newspapers, local interviews, etc.) can be used to identify the area affected and general damage and flood plain characteristics. Two key elements are detail maps of the study area and establishment of a clear definition of the study area. Beginning point of damage; number of acres flooded; number of structures by type, families, and businesses affected; road and bridge damage; total dollar damages; etc., should be documented specifying the date and magnitude (discharge, frequency, stage, etc.) of the flood event. Information should be gathered about individual and/or local protection works (flood warning systems, floodproofing measures, etc.). This information should be available to the study team so that a clear understanding of the flood problem is reflected in the study objectives and the flood reduction alternatives to be evaluated are consistent with those objectives. The data and information will also be used as a benchmark for estimated damages derived during economic, hydrologic, and hydraulic studies.

The following is an example of appropriate questions and answers necessary for this task:

What task?	Gather historical flood damage information (beginning point of damage by reach; number of acres, structures, businesses, families, roads, and bridges affected; flood dates and flood magnitude; local flood protection works; etc.) Gather data on the history of urban development, key index locations, and time required for damage recovery.
Why?	For a clear understanding of the flood problem among the study team members. To make sure the study objectives and the flood reduction alternatives are consistent with flood problems. Historical data will be used to calibrate the structure depth-damage model and hydrologic and hydraulic models.
Who?	Corps Economic Analysis Branch, GS-xx Economist
When?	Initial economic task
How?	From published and other available sources (reconnaissance studies, post flood reports, Federal and State emergency management agencies, newspapers, local interviews, etc.)
How much data are available?	Significant information needed for this task has been gathered in the reconnaissance study.
How much additional data are needed?	The beginning points of damage along major data tributaries, high damage areas, and at proposed structures will be needed. Additional interviews with Federal, State, and local officials will be required to gather more specific flood emergency cost information, road and bridge damage, and utilities damage information.
How much time and cost are required?	x man/month @ $ 0.00/hour = $0,000. x one day trips @ $00/trip = 000. Total $0,000.
Contingency?	x man/days @ $ 0.00/hour = $ 000. Additional man/days may be required due to the uncertainty in the number of structures.

TASK II - ECONOMIC DATA COLLECTION AND ANALYSIS OF EXISTING CONDITIONS

In the process of collecting and analyzing data, the economist and study team members must be aware of the uncertainty and variability that are inherent in water resources planning and design. Risk and uncertainty arise from measurement errors and from the underlying variability of complex natural, social, hydrologic, and economic situations. All measured or estimated values in planning and designing projects are, to various degrees, imprecise or inaccurate. Variables that affect project workability and human safety are of utmost importance. Therefore, evaluation of risk and uncertainty is necessary in water resource studies. Three basic tasks exist when collecting and analyzing data that the economist, in concert with study team members, must accomplish: (1) identify and analyze those variables with inherent risk and uncertainties, (2) provide leadership in evaluating the economic consequences of safety issues in design, and (3) document and articulate the results of these evaluations in a form that can easily be used by decision makers. A detailed explanation of the risk and uncertainty of each variable and methods to evaluate and illustrate this risk and uncertainty are not included in each of the following tasks. This is not meant to indicate that risk and uncertainty should be taken lightly, for it should be the main focus within plan formulation and project selection. However, risk and uncertainty analysis methodology is presented in other publications and is not within the scope of this document.

Existing economic data collection and analysis tasks can be divided into two sections: (1) social economic data and (2) existing structure and related data collection and analysis. The social economic data can be derived from published sources and included as one task. Existing structure and other data will normally require surveys and should be presented in detail by specific task.

Task II-1 - Derive Historical and Forecasted Economic Data

The most recent available studies should be used to derive the following demographic data and projections: population, personal income, manufacturing, and employment. Additional projections may be necessary for a given area depending on potential uses of these projections. The basis, sources, and method for establishing all projections should be clearly specified. The purpose of each projection should be clearly stated. This task should include enough data and information to adequately describe the social economic composition and the flood plain advantages of the area. Derived data necessary for land use projections should be coordinated with the hydrologic and hydraulic team members.

Task II-2 - Locate and Number All Structures Affected on Aerial Maps and Delineate the Affected Area into Economic/Hydrologic Reaches

Close consultation with the study team, especially hydrologic and hydraulic and formulation members, is essential. Careful attention should be given to locations of structure damage, hydrologic conditions, and potential areas that may require incremental or other special analysis. Determine cross-section locations in agreement with study team members with emphasis on areas with high damage, changing hydrologic conditions, or unique problems or needs. Determine which stream mile by which to reference individual structures by working directly with the hydrologic engineer.

Task II-3 - Determine Structure Class, Type of Construction, and Value

Determine structure class (residential, commercial, industrial, public, etc.), type of construction (brick, frame, slab, pier, basement, one-story, two-story, single-family, multifamily, etc.) by surveying all structures or a sample of structures located on aerial maps in Task II-2, including any new structures. Mapping used for structure surveys should be compatible with hydrologic and hydraulic mapping. If a sample of the structures is to be used to establish class, type, and value, an explanation of sample methodology and statistical validity should be included in the EMP. Depreciated replacement values are to be used in estimating structure value. Market value is only to be used if it can be demonstrated that it closely approximates depreciated replacement value (Engineer Regulation 1105-2-100, paragraph 6-167). Depreciated replacement values are believed to more closely measure the value of economic welfare subject to flood loss than market values. Estimation of structure value, if acquired from U.S. Army Corps of Engineers real estate appraisers or contract appraisers, should be listed as a separate task. The approximate number of structures to be surveyed and appraised should be included in the task description.

Task II-4 - Determine Residential Content Value

Describe the method used to determine content value. A sample survey could be conducted of each appropriate residential value range to determine content value. The task should describe the percentage and number of structures to be surveyed. Data from other studies with similar areas may also be used with a clear rationale and discussion of the similar area.

Task II-5 - Determine Commercial and Industrial Content

A sample survey could be conducted to accomplish this task. Data from similar areas could also be used. The task should describe the percentage and number of structures to be surveyed. Due to the diversity of industrial content, specific content surveys should be conducted if industrial damages are a significant proportion of total damages and the cost of surveys are not prohibitive.

The following is an example of potential questions and possible answers necessary for accomplishing Task II-5:

What task?	Determine commercial and industrial content value.
Why?	Commercial and industrial content value in conjunction with content depth percent damage relationships will be used to determine commercial and industrial content damage. These data are necessary for the development of a realistic economic damage model for the flood plain.
Who?	Corps Economic Analysis Branch, GS-xx Economist
When?	Data collected during the initial part of the study effort.
How?	A xx-percent survey will be conducted of approximately xxx commercial establishments. This survey percentage should yield a 90 percent confidence limit. Appropriate classes of industrial establishments will be surveyed. Fifteen trips will be required to conduct an estimated seven interviews per day. The questionnaire will include questions concerning not only content value but past flood damages. Content value data and depth-damage information will be compared to other studies for reasonableness.
How sensitive are data?	Reconnaissance studies indicated that the bulk the of damages occurred to residential development; therefore, commercial and industrial content value is not considered to be sensitive to project feasibility or selection.
How much data are available?	No area specific content value data are available? Data from other studies and secondary sources are available.
How much time and cost are required?	xx man/days @ $0.00/hour = $0,000. xx one day trips @ $00/trip = 000. Total = $0,000.
Contingency?	xx man/days @ $0.00/hour = $0,000. The survey response and the ability to contact the establishments may require additional man-days.

Task II-6 - Determine Structure Ground and First Floor Elevations

Numerous methods of determining structure elevations exist. These methods range from actual surveys of each individual structure to determining elevations from quadrangle maps. The method used depends on the desired accuracy (risk and uncertainty) and/or time and money available. The method used and its corresponding accuracy should compare to the accuracy of the methods used to derive hydrology and hydraulic data. The number of structures to be surveyed should be included in the task description.

Task II-7 - Determine Structure Depth-Damage Relationships

Depth-damage information should be developed for each structure category. This can be determined by a sample survey, similar flood studies, FEMA 'data, and/or other excepted depth-damage relationship information.

Task II-8 - Code Hydrologic and Structure Information into Format of Structure Depth-Damage Model

Code information collected and derived in Tasks II-2 through II-7 into appropriate format by reach for input into a Structure Depth-Damage computer model. Compile hydrologic stage-frequency data furnished by the hydrologic study team member into the depth-damage model. The completion of existing structure data collection and compilation should coincide with the completion of the existing hydrologic stage-frequency data.

Task II-9 - Determine Existing Structure Damage

Use the Structure Depth-Damage computer model or spreadsheet model to determine existing structure damages. Calibrate the model by comparing model existing damages to historical damage information gathered in Task I-1 and with input from the study team members. Major effort should be extended to define existing structure damages because they form the base against which all alternatives will be evaluated. Examine individual structure damage, per structure damage, damage by type, damage per reach, etc., for reasonableness.

TASK III - FUTURE LAND USE DEVELOPMENT WITHOUT AND WITH PROJECT

Estimation and measurement of flood damages to future development can be accomplished in three steps: (1) estimate the number and size of physical units, (2) estimate the future value of units, and (3) determine the damage susceptibility of units. Estimating future land use development requires knowledge and use of historical and present land use. Present and future land use data should be coordinated with the hydrologic study team member for use in the development and selection of interior plans, alignments of plans, future hydrology and hydrologic conditions, etc. A basic question requiring careful attention is, "Will the development occur without and/or with the project?" The answer to this question can be critical to project benefits and, therefore, project feasibility. Also, evaluations of future development under with-project conditions must take into account that all new development will be required by the Federal Insurance Administration (FIA) to be constructed at or above the 100-year flood elevation. The following tasks will be required to estimate flood damages to future development:

Task III-1 - Establish Land-Use Development Trends and Needs

Collect historical residential, commercial, industrial, and other construction permit data by year. Determine land development trends and needs based on collected data and other significant economic information. Land development out of the flood plain but within the basin that could have a potential effect on future hydrologic conditions should be evaluated. Any data concerning future land use development should be coordinated with the hydrologic study team member.

Task III-2 - Determine Existing Residential Lot Size

Lot size by residential area, value, flood zone, etc., may be necessary. Determine persons/household in the affected area.

Task III-3 - Determine Number of Acres of Undeveloped Land in Affected Area

Thoroughly document existing, potential, and projected land use. Federal FIA, state, and local drainage and flood zone regulations should be used in projecting land development. Allocate land use demand to flood plain and nonflood plain lands for the without- and with-project conditions. Allocate the undeveloped land by class (residential, commercial, industrial, etc.).

The following is an example of appropriate questions and answers necessary for Task III-3:

What task?	Determine the number of acres of undeveloped land in the affected area.
Why?	The number of acres of undeveloped land will be used as a limit for the amount of future development. Future flood damages/benefits will be determined after allocating the undeveloped land by class (residential, commercial, industrial, flood plain open areas, etc.).
Who?	Corps Economic Analysis Branch, GS-xx Economist
When?	When needed for hydrology or following determination of existing damages.
How?	Determine acres of undeveloped land by using available maps and coordinating with study team members, local agencies, local developers, and real estate personnel. Projections will be consistent with Federal FIA, state, and local drainage and flood zone regulations.
How sensitive are data?	The acres of undeveloped land and how this land is allocated among competing uses can be critical to project formulation and project selection. A risk-based analysis will be conducted to illustrate the sensitivity of data and assumptions used in determining the amount of undeveloped land and how it is estimated to be developed. If variations in future land use control have a significant impact on formulation, then land use will be a formulated alternative.
How much time and money is required?	x man/days @$00.00/hour = $000. x one day trip @ $00.00/trip = 00. Total = $000.
Contingency?	x man/days @$00.00/hour = $000. Only a small amount of contingency will be required due to the numerous body of available data and development trend in the affected area.

Task III-4 - Forecast the Number of Residential Structures to be Constructed

Forecast by decade using appropriate forecast methods based on population projections, economic activity, available land, lot size, persons/household, residential demand, etc. This forecast should be consistent with the available undeveloped land determined in Task III-3. A clear definition of future without- and with-project development is essential. This forecast should be coordinated with the hydrologic team member for use in developing discharge and runoff changes.

Task III-5 - Determine Damage to Future Development

Damage to future development for the without- and with-project conditions can be accomplished by either of two methods: (1) Derive the unit value of structures forecasted to be constructed and determine the damage susceptibility (structure elevation, class, type of construction, etc.) of those structures to be used in the structure depth-damage model to generate future flood damages and (2) after estimating the number of future units, a damage/unit based on existing unit damages could be used.

Estimate elevations of future units based on the land to be developed. Elevations of future units should be coordinated with the hydrologic team member. Elevations of future units with project must be at or above the 100-year elevation to meet FEMA requirements that will be enforced with the project. Both the economic and hydrology and hydraulic evaluations should account for the allowance of each development site to raise the design profile to a maximum of 1 foot. Future damages should be discounted to present values.

Task III-6 - Forecast Commercial, Industrial, and Other Development

Base forecast on historical trends, present and future needs, and available information collected in Task III-1. Communication with local realtors, developers, and community planners is useful. Survey all establishments or an appropriate number to determine expansion plans under without- and with-project conditions. Determine from surveys and available information the estimated time and value of development. Plans of large fills (loss of valley storage) should be coordinated with hydrology and hydraulic team members.

Task III-7 - Determine Damage Susceptibility of Forecasted Industrial, Commercial, and Other Development

Examine elevations of locations, construction, use, content, etc., of future development. Existing structure damage relationships can be used as a proxy for forecasted development.

Task III-8 - Determine Future Commercial, Industrial, and Other Damages

Future damages can be derived by including the structure data in the structure depth-damage program and/or base damages on existing flood damage relationships.

Task III-9 - Determine Residual Flood Damages

Residual damages are damages which occur with the project in place. Residual flood damages are determined by subtracting without-project damages from with-project damages. The remaining damages with each alternative plan should be clearly displayed in the report. Coordination with the hydraulic team member is necessary to determine residual and/or induced damages caused by interior drainage and other flood effects. Special attention should be given in regard to economic performance for projects with low average annual reductions (ER 1105-2-100).

Task III-10 - Determine Project-Induced Damages

Many times a plan that reduces total damages may in fact increase damages in areas upstream, across from, or downstream of the area (ER 1110-2-1405). Detailed evaluations should be conducted in areas where project-induce damages occur. These damages should be documented and displayed for mitigation and other purposes.

TASK IV - OTHER DAMAGE/BENEFIT CATEGORIES

Numerous damage/benefit categories exist that add to NED. Those discussed below are not all-inclusive but are key potential categories. The methods used to calculate these benefits should not be considered as the only method, because numerous methods may exist between and within categories. Methods described illustrate the thought process and information that should be included in the EMP.

Task IV-1 - Reduction in Emergency Costs

Emergency costs include those expenses resulting from a flood that would not otherwise be incurred, such as the costs of evacuation and reoccupation, flood fighting, and disaster relief; increased costs of normal operations during the flood; and increased costs of police, fire, or military patrol. Determine historical emergency costs from specific surveys and/or research. Use historical emergency costs of specific flood events to estimate emergency costs under without- and with-project conditions.

Task IV-2 - Reduction in Floodproofing Costs

Flood hazards normally lead to high floodproofing costs. Typical floodproofing measures include construction on piers and land filling. Therefore, determine the floodproofing costs of different activity-types within different flood hazard zones. Floodproofing construction costs can be derived from local developers and construction representatives. Determine floodproofing reduction benefits by subtracting floodproofing costs under without- and with-project conditions.

Task IV-3 - Reduction in Cost of Administrating National Flood Insurance Program (NFIP)

The cost of servicing flood insurance policies in effect at the time of the study is the average cost per policy, including agent commission, and the costs of servicing and claims adjusting. Cost/policy can be acquired from the Corps annual economic guidance memo from the FIA. Under the FIA program, all new developments within the 100-year flood zone are required to be constructed at or above the 100-year flood elevation and flood insurance has to be purchased. Benefits are determined by multiplying the insurance administration cost with the number of structures that are removed from the NFIP under with-project conditions. An effort should be made to estimate the number of structures that have flood insurance. Without actual knowledge of the number of structures with flood insurance that are removed from the 100-year flood zone, a realistic assumption should be made.

Task IV-4 - Benefits from Modified Use

The flood hazard may cause structures to be used less efficiently than they would be with a project. If the type of flood plain use is unchanged, but the method of operation is modified because of the plan, the benefit is the increased net income generated by the flood plain activity. Determine this benefit by calculating the increase in efficiency due to the project. Surveys and interviews with local leaders can be used to determine structures that could be used more efficiently under with-project conditions.

Task IV-5 - Location Benefits

If an activity is added to the flood plain because of a plan, the benefit is the difference between aggregate net incomes (including economic rent) in the economically affected area with and without the plan. The benefit can be measured by the change in the net income or market value of the flood plain land. Determine the number of acres available for location benefits based on information derived under Task III. Determine the net change in income or market value under without- and with-project conditions. Determine the cost of floodproofing whether by construction design or the cost of fill required to elevate above the 100-year elevation under without-project conditions. The benefit will be the lesser of the market value method or the cost of fill.

Task IV-6 - Reduction in Income Losses

Loss of wages or net profits to business over and above physical flood damages usually results from a disruption of normal activities. Prevention of income loss results in a contribution to NED only to the extent that such loss cannot be compensated for by postponement of an activity or transfer of the activity to other establishments. Estimates of this loss/benefit must be derived from specific independent economic data for the interests and properties affected.

Task IV-7 - Reduction in Damages to Automobiles

The following information should be collected and/or examined when estimating flood damages to automobiles: automobiles/household, households/flood zone, value/automobile, automobile depth-damage relationship, depth of flooding by flood zone, flood-warning time, flood velocity and duration, and historical automobile flood damage. Determine damage reduction benefits to automobiles by analyzing this information under without- and with-project conditions.

Task IV-8 - Reduction in Damages to Utilities

Benefits can be derived from flood damage reduction to power lines, sewers, waterlines, and telephone and television cables. Utility damages should be determined by specific surveys or research. Historical flood damages are the base for estimating utility flood reduction benefits.

Task IV-9 - Reduction in Damages to Roads and Bridges

Specific surveys of Federal, state, and local agencies or research should be conducted to determine historical flood damages. Compare historical damage information and damage susceptibility under without- and with-project conditions to determine damage reduction benefits.

Task IV-10 - Restoration of Market Value

If the market value of existing structures and land is lower because of the flood hazard, a benefit can be calculated when restoration of the market value is due to the project. The benefit is the difference between increased market value and that portion of increased value attributable to reductions in flood damages. This benefit can be estimated by comparing flood zone property with similar flood-free property. Careful attention should be given to ensuring that factors not related to the flood hazard are not included as project benefits.

Task IV-11 - Reduction in Transportation Costs

Flooding can cause an increase in transportation costs due to delays and rerouting. Historical flood events along with their delay times, rerouting mileage, and transportation costs should be examined. Transportation cost reduction benefits can be determined by comparing cost under without- and with-project conditions.

Task IV-12 - Benefits That Accrue During Project Construction

Coordinate with the study manager and construction and hydraulic team member to determine effects during construction. Benefits occurring during project construction should be documented and included in the benefit evaluation. These benefits should be brought forward from the time the benefits begin to the beginning of the period of analysis, using the project discount rate. All benefits and costs are stated in present worth terms as of the beginning of the period of analysis. Benefits and cost should be identified explicitly. It is not acceptable to simply assume that benefits accruing during project construction are offset by interest during construction.

Task IV-13 - Benefits Due to Employment of Unemployed or Underemployed Labor Resources

The economic effects of the direct use of otherwise unemployed or underemployed labor resources during project construction or installation may, under certain conditions, be included as an NED benefit. These benefits can be claimed if the area has substantial and persistent unemployment at the time the plan is submitted for authorization and for appropriations to begin construction. Refer to ER 1105-2-100 for details on benefit calculation and the annual economic guidance memorandum to determine if the study area qualifies.

V - DEVELOPMENT OF PROJECT MANAGEMENT PLAN

A PMP should be developed that details economic studies and necessary study tasks that will be required during the preliminary engineering and design phase of the study. A plan for any required economic update should be included. The same questions should be asked during the development of the PMP: WHAT?, WHY?, WHO?, WHEN?, and HOW?

VI - PREPARATION OF ECONOMIC APPENDIX

A benefit-cost analysis for each alternative plan should be conducted. Projected benefits and costs should be discounted and amortized for comparison purposes. Display projected average annual benefits to projected average annual costs for each alternative. A summary for each alternative should be presented to display annual benefits, annual costs, the benefit-to-cost ratios, and net excess benefits over costs. The plan with highest net excess benefits will be designated as the NED plan. This will be the selected plan unless sufficient justification can be presented to recommend another plan.

Determine the sponsor's financial capability. A financial analysis should consist of a non-Federal sponsor's statement of financial capability and financing plan and the District Commander's assessment of the non-Federal sponsor's financial capability. The analysis should include the total obligation the non-Federal sponsor will be required to pay over the life of a project.

The economic appendix should clearly describe the existing and future without-project social and economic conditions. This provides the base from which all comparisons are made. The alternatives evaluated should be described emphasizing their social and economic objectives. Future without- and with-project damages should be displayed by decade. Summary tables should include pertinent land use data for computing not only NED benefits, but also environmental, social, and regional impacts. Detail description, including method of computation with a display of each damage/benefit category, should be included in the report. The existing condition benefit-cost ratio of the recommended plan should be displayed. The report should clearly document any pertinent economic information and method of analysis. An explicit display and narrative of the variables that demonstrate significant risk and uncertainty should be included. The economist should present the economic data and analysis in a logical manner and form to facilitate the review and decision-making process.